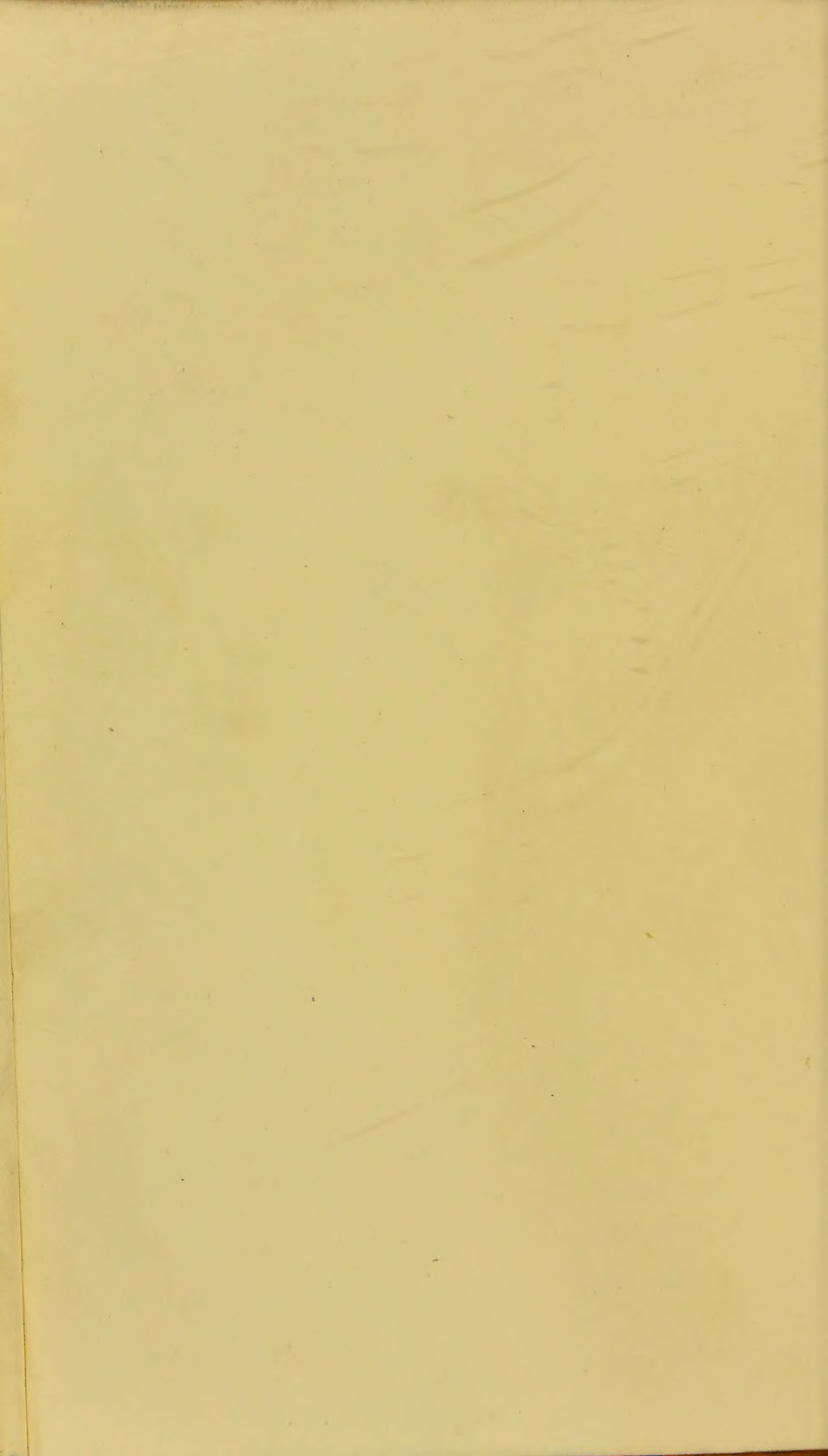




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A SYSTEM OF SURGERY.

THEORY OF ALGEBRA

A SYSTEM OF SURVEY

AND THE ARTS

BY J. H. COOPER

A

SYSTEM OF SURGERY

BY

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PREFACE.

THIS New Edition has been carefully prepared with a desire to constitute a complete System of Surgery, brought up to the level of Science in the present day.

In labouring to this end, I have to acknowledge, very gratefully, much valuable aid received from Dr. P. H. WATSON.

JANUARY 1864.



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CHAPTER I.

THE INFLAMMATORY PROCESS.

INFLAMMATION—the word in ordinary use, to express that state of elementary disease which is so common in both medicine and surgery—might be defined : An alteration in the healthy structure and function of a part, accompanied by a perverted condition of the blood, blood-vessels, and nerves ; ordinarily attended with redness, pain, heat, swelling, and with more or less febrile disturbance of the general system.

But this term has, in my opinion, been made to include too wide a range—from the slightest exaltation of what is healthy, to the most disastrous results of ravaging disease ; as if identifying the healing of a wound with its gaping and suppuration—the gradual enlargement of a part, with its destruction and discharge—the death of a portion of bone, with the formation of its substitute—the successful reunion of a broken limb, with the suppurative arrest and undoing of the callus—the production of an ulcer, with its process of healing ; all, however dissimilar, declared the offspring of one common parent—Inflammation.

The practical confusion likely to result from such a state of things seems full warrant for the surgeon to attempt a division of what is so extensive and varied, into its component parts ; and to inquire whether separate causes or conditions may not be found to suit the results so widely different.

As a suitable general term, comprehending the whole range, “THE INFLAMMATORY PROCESS” may be employed ; and this, again, following the arrangement of Nature, may be divided into three stages, the *Serous*, the *Plastic*, and the *Suppurative*—conditions easily appreciated by ordinary sight and touch.

The whole change is, in truth, one of perverted nutrition ; the formation of new material and the removal of the old having lost their normal harmony, and one or other, or both of these processes, occurring in excess. In the first stage, the nutritive excess is mainly serous ; in the second, it is of plastic material ; while in the third, or suppurative, the texture of the part affected becomes more or less rapidly broken up, along with a more or less copious formation of a new and peculiar matter named Pus—itself incapable of repairing the advancing loss.

From health to suppuration is not one step, at once attained, but a transition gradually effected ; the time occupied varying according to circumstances. In some cases a very few hours suffice ; in others, days may have elapsed, and yet the process is incomplete.

Let us take a common surgical example ; the application of some acrid substance to the skin. Each component texture of this part may be affected, so soon as brought into contact with the irritant ; while, in

sensitive parts, one tissue is involved more obviously than the rest. This is the nervous ; and hence immediate pain, by the effect on its sensory portion. An impression is thus conveyed from the part to the nervous centre ; thence follows a reflex stimulus to the part, already roused by the direct influence of the irritant, and that stimulus is in due time obeyed.

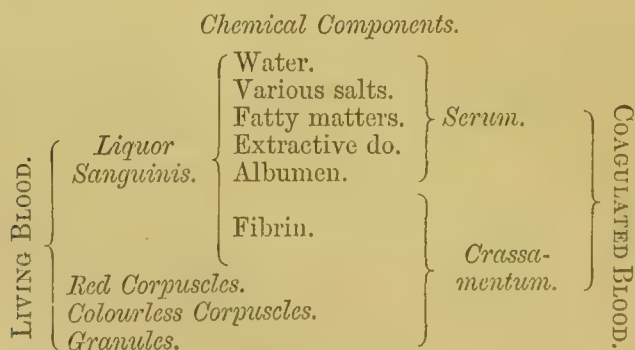
The time which elapses between the application of the exciting cause and the establishment of the morbid process thereby induced, is termed the period of *Incubation* ; varying as to duration ; in some cases very brief, in others protracted ; always valuable with regard to treatment.

I. There is a determination of blood* to the part ; according to some, the immediate result of the impression on the nerves, in those cases where a wound or other mechanical irritation has occurred ; according to others, the consequence of a change having already taken place in the nutrient condition of the texture—a change at once antecedent and attractive. At first the small arteries, probably, contract in their calibre, so retarding the flow of their contents ; but such spasm is usually very brief and transitory—often not observed at all ; and is followed by advancing dilatation of the canals, affording both greater volume and greater rapidity to the circulation. Soon enlargement beyond the normal standard is reached by the capillaries as well as the corresponding arteries and veins.

Capillaries which previously contained but single files of the red corpuscles, now admit of them rolling through in masses ; and these come crowding in. In consequence, vessels formerly invisible are now seen plainly ; and the accelerated motion of the general current is as yet but little abated. As dilatation increases, however, the flow tends to become more and more retarded ; and the blood parts with a portion of its contents more liberally than in quiet health. What is parted with may be chiefly serum, accumulating on open surfaces and in interstitial spaces, and there shewing more or less of the character of the liquor sanguinis. The natural function of the part is disordered. If this be secretion, the secreted fluid is increased in quantity.

Thus is constituted the first stage, sometimes termed *Simple Vascular Excitement* ; not necessarily inconsistent with health ; synonymous with

* DIAGRAM OF BLOOD.



The solid portion of living blood, containing iron, and carrying oxygen, may be said to minister specially to respiration ; while the fluid part is peculiarly concerned in the function of nutrition.

the *Vital Turgescence* of some Physiologists. The part contains an increased amount of blood ; there is a marked tendency to increased product, partly serous, partly of a lymphous kind.

The exciting cause having been removed, this condition may soon subside, and the part recover itself. Or, the exciting cause remaining, the disturbance may be sustained, yet without proceeding to a higher grade ; a salutary result being perhaps secured thereby—more especially when the product happens to be mainly on a free surface. For instance, it is by the continuance of such simple turgescence of the lachrymal gland that a grain of sand lodging in the conjunctiva is washed away.

But, the irritant remaining—or being severe in its nature, though of brief application—there is neither abatement, nor simple maintenance of the changed condition, but advance ; and this brings us to the second stage.

II. The vascular commotion extends on the cardiac side of the affected part ; the arterial trunks feeding it have partaken in the disorder, have begun to be enlarged, and to pulsate with unwonted energy. More and more blood is sent down to the part ; the capillaries and minute arteries and veins yield more and more to their burden ; the tone in the vascular coats is becoming exhausted, and enlargement is about to be merged in over-distension. The circulation loses its acquired rapidity, and becomes slower even than in health ; the red corpuscles are no longer limited to the central current, but encroach more and more on the lateral and clear “lymph spaces ;” while product is more copious than in the previous stage, and of a different kind. It consists chiefly of fibrinous fluid ; in which structural elements are found of a plastic kind, along with multiplication (or hyperplasy) of the elementary cells of the part. There is also an excess of chloride of sodium and of phosphates—a chemical change common indeed, more or less, to all inflammatory products.

The natural function of the part is now becoming perverted : for example, secretion is not only increased, but changed in its character. By accumulation of the lymphous product, the texture of the part is softened and enlarged. The “formative power,” as it is termed, is disordered ; and the supply of plastic material is greater than can be usefully and normally appropriated by the implicated tissues. In other words, nutrition, or the normal and vital relation which subsists between the living



Fig. 1.

Fig. 1. The ears of a rabbit—*a*, healthy ; *b*, the inflammatory process commencing, shewing the dilated state of the vessels, and increased size of the part.—PAGET.

tissue and nutrient materials contained in the blood, is becoming more and more disturbed. More of the fluid part of the blood is put down



Fig. 2.

than is needed for, or can at once be employed in, the ordinary supply, compensatory of wear and tear. And this, perhaps, constitutes the most

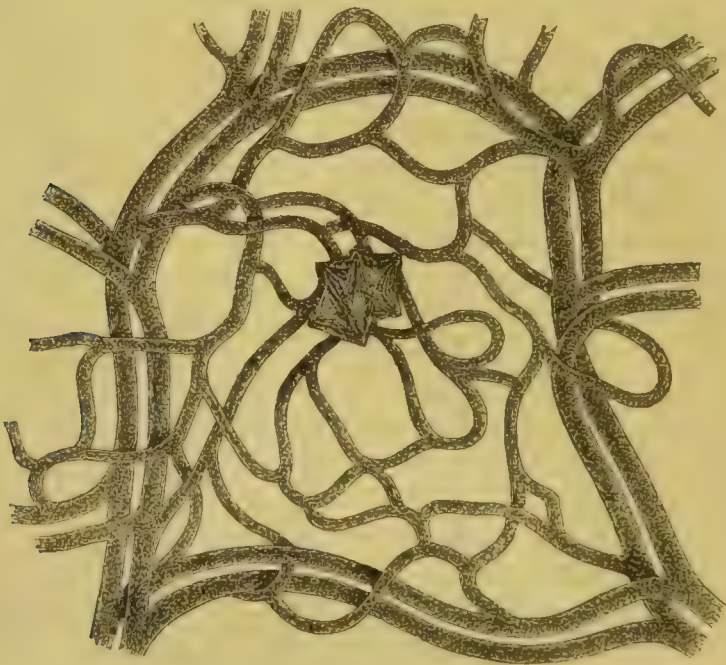


Fig. 3.

important part of the inflammatory process ; leading ultimately to change of structure, more or less permanent, and more or less inimical to resumption or continuance of normal function.

Fig. 2. Vascular plexus from the web of a bat's wing before the inflammatory process has begun.—PAGER.

Fig. 3. The same after the inflammatory process has begun ; the dark point in the centre marks the wound or cause.

Thus is constituted the second or plastic stage, sometimes termed Active Congestion; the feeding arterial trunks dilated, but the circulation slow in the part; its vessels overdistended, and without tone; its blood undergoing change, the fibrin especially being increased; extravascular fibrinous product accumulating more or less copiously; function and nutrition perverted. We are leaving the confines of health, and have, indeed, already made some progress into the territory of disease.

This process may stop and recede after the removal of its simple exciting cause; or it may be sustained for some time, as in the healing of wounds and the closing of ulcers; or it may advance to

III. *The Third or Suppurative Stage*, sometimes termed *True Inflammation*.—The change which, in the preceding stage, had begun in the circulation is now completed. The overdistension of the capillaries is established; and the coats of the vessels are spongy, softened, and impaired in cohesion, being themselves the subjects of structural change. The languor of circulation approaches stagnation, and at some points this has actually occurred; while every part of the distended capillaries is occupied by crowded corpuscles, coloured and colourless. Fibrinous serum collects extravascularly in profusion. The attenuated and softened capillaries give way in their coats here and there; and from the lesion blood is extravasated in mass. Suppuration is in progress; according to some by intrinsic change in the product which they believe to be transuded—molecules and granules forming out of what was at first structureless, and these again grouping together and becoming surrounded by a membrane, so as to form cells; according to others, and more probably, by the cells of the primary texture acting formatively, and themselves producing (*cellula e cellulâ*) the solid or organized part of the new formation. The parenchyma, infiltrated with serum, fibrin, pus, and blood, softens, and is broken up; and the disintegrated texture becomes mixed with the escaped contents of the vessels. The formative power, while excited, aborts—reaching no higher than the pus formation; and the opposite condition, or disintegration, has become paramount. Disorder of function is complete; secretion, for example, being in the first place arrested, and, when restored, become more vitiated than before.

In the circulation of the part itself, all is sluggishness and stagnation; but that of the parts around is unusually active. The arterial trunks in the vicinity continue to play with increased energy; blood continues to be sent, but cannot now be transmitted in its direct course: in the inflamed part it meets an obstruction, and, being sent round another way, throws a stress on the collateral vessels; these, however, retain vigour sufficient for the augmented labour, and pass the current briskly round.

While the nutritive tumult is thus busy—much new raw material coming, and much of the old softening and crumbling away—the removal of the latter is comparatively obstructed; absorption is in abeyance—the lymphatics and minute veins doing little in that way. On the disease yielding, however, absorption again comes into play; and the part is often restored nearly, or altogether, to its former state. During inflam-

matory affection of a serous membrane, for instance, a large amount of liquid product often rapidly accumulates within its cavity, and so long as the disease persists, that fluid either remains stationary or receives an increase ; but so soon as the inflammatory process has fairly given way, and resolution is in progress, the accumulation plainly diminishes, almost *pari passu* ; and in two days, or perhaps in but a few hours, it may have in great part disappeared.

The inflammatory change of the blood is important. 1. The liquor sanguinis is increased in relative quantity, and its serum is said to contain an unusual amount of albumen. 2. The fibrin is increased in quantity ; both actually, and relatively to the red corpuscles. The proportion of serum is diminished. 3. The red corpuscles are relatively diminished in number ; and their tendency to aggregation is augmented. 4. The colourless or "lymph globules" seem to be frequently increased in numbers ; but this change is by no means essentially connected with the inflammatory process, as some have supposed.

This alteration of the blood—begun in the second, and completed in the third stage—is at first a local act, effected in the part inflaming ; but this laboratory, if continued in operation, may ultimately involve the whole circulating fluid in similar change.

To recapitulate—The characteristics of the third stage are—Blood much altered ; stagnant, or tending to stagnation. The capillaries over-distended ; the vascular tissue, generally, spongy, soft, and lacerable. The neighbouring collateral circulation unusually active. Copious product of fibrinous serum ; extravasation of blood, by lesion of the capillary coats ; absorption in abeyance ; nutrition and function wholly perverted. Structure changed, softened, and enlarged. Suppuration in progress ; and part of the texture breaking up. Nothing healthy, or consistent with local health ; all essentially disease.

This state is not established at once, so soon as the period of incubation has passed away ; but, as already stated, is approached by a process of transition more or less gradual. When somewhat tardy, its compound nature is the more distinct. Take, for illustration, the vaccine pustule ; the inflammatory process resulting from a poisoned wound, and gradually attaining to its consummation. The exciting cause is applied, and for a time seems to be inoperative ; three days commonly elapse, without the appearance of change ; and this is the period of incubation. On the fourth day, the *papular* condition is established ; commencing with simple turgescence, and steadily verging towards the second or plastic stage. During the four following days, the *vesicle* is formed ; at first containing a serous fluid, which afterwards becomes of a more lymphous character. On the ninth day, the *pustular* formation is attained ; the third or suppurative stage having been completed. This is the crisis. Soon thereafter, the signs of disorder ordinarily subside, and the part slowly recovers.

During the morbid progress, advancement is usually at and from the irritated part as a centre ; and, supposing a section made of the inflammatory disc, the accompanying diagram may conveniently illustrate the state of the part ; suppuration, actual or imminent, surrounded by fibrinous product, and that encircled by accumulation of serum.

Every day's experience illustrates this. In the detection of deep abscess, for example, the subcutaneous areolar tissue is found œdematous ; beneath this a firm hardness is felt ; while within this, again, is the soft site of suppuration.

Hitherto we have been treating of inflammatory change as occurring in vascular tissues. In these, disintegration of texture in the third stage is always accompanied with suppuration. And in non-vascular tissues, as in articular cartilage and the cornea, we observe an advancing process, analogous in all respects to the inflammatory, so far as structural results are concerned, culminating in destruction of texture by change of cell-formation, with the production of cells structurally the same as those of pus.



While asserting that inflammatory disintegration of texture is always accompanied with suppuration, it is right further to explain, that the converse by no means holds true. Suppuration is not always accompanied with disintegration of texture. On mucous surfaces, for example, and on the walls of open abscesses, we often observe very copious formation of pus, while the inflammatory process has declined from the third stage—which originated the suppuration—and rests in the second.

It has often been disputed whether the inflammatory change implies increase or diminution of vital strength in the part—an excitement or a debility ; and both extremes have been tenaciously held and argued. In the earlier stages of the process the advocates of excitement, or increased vitality, may still hold their ground, so far as increased formation of cell-structures can be taken as a test of such vital energy ; but when the third stage has been reached, evidence of vital depression in the part is plain and indisputable.

From such depression the part recovers slowly ; and sometimes only in degree—often remaining, at least for a long time, both more prone to disease and less able to control it ; a fact which it is of much importance that both patient and practitioner should remember.

Local Symptoms of the Inflammatory Process.

The consecutive changes which we have endeavoured to describe are ordinarily accompanied and indicated by certain signs ; redness, swelling, heat, pain, increased sensibility, throbbing, and disorder of function.

1. *Redness.*—The more fully a part is injected with blood, the redder is its hue. An inflaming texture, as we have seen, has its amount of blood much increased ; and its colour is necessarily heightened thereby. And not only are the vessels unusually gorged with blood ; that blood is unusually red ; much of the liquor sanguinis having moved on from the field of actual or threatened stagnation, leaving the overdilated vessels filled chiefly with an agglomeration of corpuscles. The cause of redness, then, is obvious.

The extreme vascularity of certain parts when inflamed, the conjunctiva for example, has been supposed to depend in part on the formation of new vessels. But it is not so ; at least in the first instance. Minute vessels, in health, carrying the red corpuscles without crowding, are invisible to the unassisted eye ; during the inflammatory process they are dilated, burdened with corpuscles in mass, and plainly seen ; appearing to have grown up suddenly by a new creation, but being in truth only an enlargement of texture previously existing. The formation of new blood-vessels is a gradual and never an immediate process ; as will be explained in the proper place. Ultimate increase of vascularization is frequently connected with the milder grades of the inflammatory process, but is incompatible with the advanced, or suppurative stage, which, occurring in the interior of a part, is adverse to all formation of tissue, and essentially destructive.

The *degree* of redness varies according to the natural vascularity of the part, and the advance of the process, or, in other words, according to the degree of engorgement, and the number of vessels which are engorged. It is a familiar test of the violence of the disease, in its early stage, to look to the amount of redness. And, again, we find an inflaming tendon less florid than inflaming skin ; inflaming skin less red than inflaming mucous membrane.

The *tint* varies according to the character, site, and accompaniments of the affection. A bright arterial red is exhibited by what is acute and sthenic ; the chronic and asthenic presents a dark, venous, or purple hue ; a bright arterial zone around the cornea characterises the internal inflammatory affections of the eye ; a close and dark network of wide-spread venous radicles indicates the presence of conjunctivitis ; while great attendant biliary derangement gives a yellowish red anywhere, as in some forms of erysipelas.

The colour of an inflaming part is usually modified, also, by the distended vessels giving way, and extravasation taking place into the inter-vascular spaces. A familiar instance of this is known to the physician, in the rusty sputum of pneumonia ; the effect of extravasation into the air vesicles of the lung.

The *extent* and *form* of redness vary ; sometimes limited to but a spot, as in the common pustule ; sometimes occupying a large space, as in erysipelas, and in the corresponding affection of mucous membrane. Sometimes in one unbroken sheet, as in erysipelas ; sometimes in lines or patches, as in affection of the veins and lymphatics. Sometimes gradually lost by diffusion in the surrounding normal hue, as in phlegmon ; sometimes carrying an abrupt bright margin, as in the erratic erythema.

One of the most important characters of inflammatory redness is its little liability to *sudden* remission or increase. Other redness may come and go, as the blush of shame, or the glow of warmth ; but the inflammatory is fixed. By the pressure of a finger it may be made to disappear for a moment, but the pale dimple is quickly filled up and coloured as before ; all trace of the touch almost instantly vanishing, like the passing of breath from a mirror. But not only has it no flitting tendency ; it must be *conjoined* with other symptoms. A crimson spot on the hectic

cheek is sometimes fixed there, with little or no alteration ; but there is neither pain nor swelling ; it is not conjoined with other signs ; it is not inflammatory.

Of change in the internal organs, under inflammatory influence, we cannot speak so confidently as of what is external and visible. But observing the successive alterations in the retina and choroid, by means of the ophthalmoscope, we may reasonably infer that in the matter of injection or colour there is no difference between the deep-seated and superficial parts.

2. *Swelling*.—Unwonted accumulation of blood will alone occasion this ; but it is also caused by the presence of an increased quantity of fluid in the intervascular spaces. In the earliest stage, the increase is chiefly serous. In the second stage, it contains fibrin in solution, and this is of high plasticity. In the third stage, the fibrinous product is continued, but of impaired plasticity ; with it is mixed blood, extravasated in mass, the result of vascular lesion ; and ultimately purulent formation is more or less advanced. So that, again referring to the diagram :—Centrally we have a soft fluctuating swelling, where there are blood and pus, and more or less of broken-down texture ; surrounding this, a dense and unyielding circle, somewhat diffuse, and usually less prominent than the centre—the result of plastic fibrinous accumulation ; and exteriorly to both, a soft pitting oedema, more or less extensive, according as the areolar tissue has been filled by the serous product. The combined result is softening of texture, and impairment of cohesion, as well as enlargement of the part.

Swelling, like redness, will not alone indicate the inflammatory process ; it must be *conjoined* with other symptoms. In simple oedema, there may be much swelling ; yet there is nothing inflammatory.

It is also of *gradual* and *recent* formation ; not suddenly developed as is the bulging of a hernia or dislocation, or the sanguineous infiltration immediately following a blow ; nor of a tedious growth and ancient origin, as is the genuine tumour—fatty, fibrous, or malignant.

The *tendency* of swelling is beneficial or otherwise, according to the part affected. If this be internal, of delicate texture, and important in function, swelling there may prove in the last degree injurious ; as in the brain. Or a part, itself comparatively of little importance, may be in the immediate vicinity of one which is of the greatest ; and enlargement of the former may re-act on the latter most injuriously. Swelling of the orbital areolar tissue will so affect the eyeball ; and inflammatory tumour of submucous tissue may fatally occlude a mucous outlet—as the glottis. On the other hand, swelling is usually rather a fortunate occurrence, and encouraged as such by the surgeon, if the part be situated externally—as the ordinary subcutaneous areolar tissue ; or if it be neither itself of delicate texture, nor endowed with function essential to the animal economy, nor closely connected with one which is either or both—as the textures occupying the intermuscular spaces.



Fig. 4.

Fig. 4. Example of inflammatory swelling. Tongue swoln, by glossitis.

Of this favourable kind are very many of the swellings with which the surgeon has to deal ; as in erysipelas, phlegmon, fractures, bruise, etc. It is, therefore, an error invariably to regard the amount of swelling as a certain index to the extent of mischief. On the contrary, it is often to be invited to the part, and, when there, promoted in its advancement.

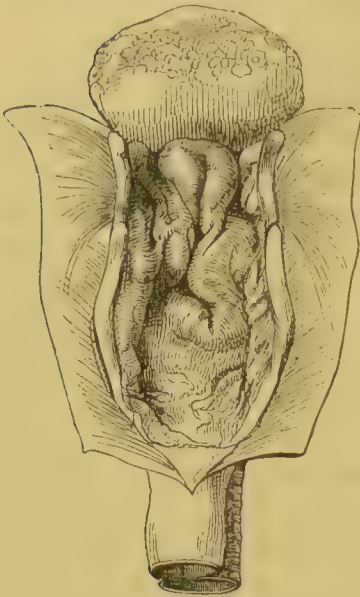


Fig. 5.

The production of plastic fibrin will afterwards be seen to be further advantageous, as constituting a most important limit to the central suppuration, when that occurs.

From what has been said, it is already apparent how the tendency of swelling is prominently connected with the texture of the part ; the less yielding, the less favourably disposed for the accumulation of inflammatory product. The process advancing, so does production from the vascular contents ; but

should the texture refuse to accommodate this growing addition to its bulk, there arises, as it were, a struggle between the unloading vessels and the unyielding part, the issue of which is sure to be disastrous. It is the surgeon's office to watch this, and to maintain or restore harmony, if possible. Otherwise, pressure from the pent-up product re-acts disadvantageously on the blood-vessels and nerves of the part ; tension is soon accompanied by throbbing, heat, and violent pain ; the morbid process has received a fresh impulse, and advances accordingly. Or the tightness of pressure thus caused may be so great as to arrest the entire circulation of the part, already inclined to stagnation ; so rendering gangrene inevitable.



Fig. 6.

Hence it is that rapid swelling in a loose texture tends usually to relief, as in the ordinary areolar tissue ; while swelling in that which is unyielding requires both constant and skilful care, and even then does injury. Acute inflammatory swelling in bone, or beneath a tightly spread fascia, or between bone and its fibrous periosteum, are occurrences invariably severe, and prone to result in destruction of texture. Acute disease, with rapid accumulation in and beneath the sclerotic conjunctiva, is comparatively harmless ; while, beneath the retina, bound down by the unyielding sclerotic, the result must necessarily prove destructive.

3. Heat.—This is a symptom seldom absent, or devoid of prominence. And it is easy to imagine how it should be so, when we remember that the source of such heat is to be found in the changes effected not only

Fig. 5. Example of swelling in submucous tissue, producing a fatal result by occluding the glottis. Acute oedema glottidis ; exposed from behind.

Fig. 6. Example of intervascular inflammatory product. Plenty of this will account satisfactorily for swelling.—BENNETT.

in the blood, but also, and mainly, in the textures of the part—more especially during the advanced stage of the process, when the formation of new and the destruction of old tissue is being rapidly carried on. From this cause, as well as from mere increase of blood in the part, the temperature is necessarily elevated above its former and ordinary range ; as is apparent to the touch, and proved by the test of the thermometer. But nerves of sensation, partaking in the general disorder of the part, have in consequence their functions excited and perverted. In truth, increased sensibility is one of the signs of the inflammatory process. And bearing this in mind, we can readily understand how the patient should feel a greater degree of heat than the thermometer would indicate. The inflammatory heat, therefore, is partly actual, as ascertained by the touch or thermometer ;* partly the result of perverted nervous function, estimated only by the patient.

This heat, like the redness which is so closely connected with it, is seldom very transitory ; indeed its fixedness is characteristic. Blushing brings heat as well as colour ; but both are evanescent.

Heat must also be conjoined with other symptoms. In hectic, there is often a constant burning in the hands and feet ; yet no inflammatory change is there.

4. *Pain*.—Of all the symptoms of the inflammatory process, this is probably the most characteristic. Yet pain is not unlikely to deceive.

Nerves of sensation, in the part inflaming, have, as already stated, their function excited and perverted ; themselves partaking in the general change, they are compressed by the distended vessels, more especially when lodged in the same fibrous sheath ; and such pressure is most materially increased by accumulation of the inflammatory product, particularly if this be situated in an unyielding texture. Besides, at each throbbing impulse of the blood, the arterial vessels, themselves altered in their coats, undergo not only dilatation but elongation ; from this the *nervi vasorum* must more or less suffer, and they contribute something to the general amount of pain. That pressure is somewhat concerned in producing the pain may be inferred from the fact, that this symptom is invariably aggravated, and chiefly felt, when compression of the inflaming part is increased—as by the hand in peritonitis, or by inspiration in pleurisy. Over and above this, however, there is inflammatory pain which cannot be accounted for on any mechanical theory.

Inflammatory pain is not uniform, but influenced by the intensity of the disease and the nature of the part affected. The more rapid and intense the former, *cæteris paribus*, the greater the pain. In a part originally sensitive more pain is felt than in one naturally dull—even although under a less amount of disease ; an erysipelas limited to the true skin, and tending only to serous change, is far more painful than suppuration of the subcutaneous areolar tissue. As formerly stated, pain is also modified according to the power of yielding in the part ; inflammatory affection is more painful in bone than in skin ; erysipelas is more pain-

* The natural temperature of the body varies from 98° to 100°, at the heart and on the trunk, and is about 92° at the extremities. In parts inflamed, the thermometer has indicated a rise to 101°, 104°, 105°, and even 107°, of Fahrenheit.—(Article INFLAMMATION, *Cyclopædia of Practical Medicine*, p. 738.)

ful than a similar affection of mucous membrane ; while an attack upon serous and fibrous tissues is more painful than either.

Pain is not always inflammatory : it may be the attendant on spasm, or on simple irritation. The pain of spasm is intensely violent from the outset ; and, though often abating more or less during its stay, seldom advances to a higher degree than that with which it began. Inflammatory pain, on the contrary, usually commences with a slight amount, and steadily advances ; hourly increasing, until either the disease is subdued or the part has perished by gangrene. Pain of spasm is often relieved by pressure ; at all events is not aggravated by it. In the inflammatory, pressure, even slight, is quite intolerable. In colic, a grateful sensation may be produced by placing weight upon the belly, while in peritonitis the slightest touch is torture.

In neuralgia—an example of Irritation—pain is severe at its first onset, like that of spasm ; it remits much and variously during its course ; and often intermits wholly, during intervals more or less prolonged. Inflammatory pain may remit, but only slightly ; and it is never intermittent. It may disappear suddenly ; but then it is not likely to return—the part having, in all probability, ceased to be amenable to further vital change.

Such are characteristics of inflammatory pain. It usually commences in a comparatively slight form, and steadily increases ; it is constant, until either the disease resolve or the part die ; and it is invariably aggravated by pressure.

Sudden disappearance always excites suspicion ; for this is inconsistent with its ordinary character ; which is, to grow steadily as the disease advances, and to subside as this recedes. In neuralgia, excruciating agony often ceases in an instant, for some hours is wholly absent, and then probably returns as violent as before. But it is not so with inflammatory pain. On its abrupt cessation, we do not dream of a mere remission of its cause ; but suspect, and too often with truth, that the part is no longer capable of sensation, and has lapsed into gangrene. For example, a portion of bowel is acutely inflaming, connected with hernial protrusion or not ; the pain is excruciating ; on a sudden it ceases, and the patient gratefully expresses his relief, and thinks he is better, perhaps safe ; the surgeon, on the contrary, is alarmed, and looks to the pulse, the surface, and the face ; he finds them feeble, cold and clammy, and collapsed ; the part has mortified.

In the inflammatory process pain is sometimes absent, or, as it were, *latent*. An acute abscess may have formed in a limb previously paralytic, deprived of sensation as well as motion ; and the patient's attention may have been scarcely attracted to the part, by the perception of aught unusual. Or injury of a limb has been accompanied with affection of the brain, inducing coma, perhaps long continued ; and in the limb inflammatory change may be advancing destructively, yet without pain being either felt or evinced by the sufferer. In such cases, the surgeon has, as it were, to feel for his patient, and, in the absence of all expression of pain, be unusually attentive to the other symptoms of local disorder.

Pain sometimes may be termed *sympathetic* ; referred to a part at a

distance from that in which the disease resides. Such a part is either connected intimately, by function, with the other; or it contains the terminal expansion of nerves, whose trunks pass through or near the inflaming part. Thus we may have disease of the hip causing infinitely less pain in that joint than in the region of the knee; abscess of the liver producing pain in the shoulder; affection of the pelvis of the kidney causing pain at the orifice of the urethra. It is of the utmost importance that the practitioner bear this in remembrance; otherwise he may be leeching the knee, instead of the hip; rubbing the shoulder, instead of attacking the liver; looking for the outbreak of a gonorrhœa, instead of opposing a renal malady which is soon to bring life into imminent peril.

Pain is of itself a formidable thing; if intense and constant, certain to exhaust the powers of life; and, in consequence, in many inflammatory affections it must be overcome at whatever cost. Also, when the part inflaming is an internal organ, intimately connected with the ganglionic system of nerves, the pain is of a peculiarly depressing nature, and highly dangerous by continuance. But, ordinarily, the attendance of pain may be viewed rather as of a salutary tendency. Were the affection painless, practitioner and patient might be unaware either of its existence or of its extent, until too late to save texture, function, or even life.

When an inflammatory process is the result of the direct application of an exciting cause—as by wound, heat, or acrid substance—pain usually precedes the vascular disorder; an immediate effect on the nerves of sensation. This may continue, more or less, and become merged in the inflammatory pain; or it may soon cease, leaving the greater portion of the period of incubation comparatively free. Such pain is also not without its use, leading to precautionary and preventive measures—often more valuable than the curative.

5. *Throbbing*.—This seems to be the result of obstructed circulation in the part with increased afflux of blood to it; and does not occur, at least to any extent, until the process has reached the period of sanguineous stagnation. It varies according to the degree and extent of obstruction, the intensity of the disease which has produced it, and the position as well as the inherent sensibility of the part affected.

Experience teaches that when there is much throbbing attendant on the inflammatory process, suppuration is likely to ensue. It is easy to imagine how this should be the case; in a part with its direct circulation much depressed, and its collateral current much increased, with inflammatory product copious, and extravasation by lesion imminent.

Throbbing is painful; at each pulse the patient's sufferings are increased. It is then that the nerves, already tightened in their place by the circumjacent lymph, are most severely compressed; and it is then that the vascular coats, themselves disordered, are stretched as well as dilated.

6. *Disorder of Function*.—This, as we have seen, affects the general function of every cell-structure in the part undergoing the inflammatory process, by which the healthy balance of nutritive change and exchange is, more or less, impaired or perverted. We observe the functional

disorder, however, more particularly and evidently displayed, in parts endowed with special functions, as it affects (a) their *Sensibility*, (b) their *Activity*.

(a) *Disorder of Functional Sensibility*.—This is the result of perverted nervous function. The eye, when sound, bears a flood of light with impunity; inflaming, it winces under the faintest ray shot directly upon it. The skin, in its healthy state, bears much manipulation; in erysipelas, the slightest touch is resented. The stomach in health does not reject food, neither does sensation of discomfort indicate the presence of food; yet the same organ, becoming inflamed, is intolerant of the simplest ingesta. The bladder ordinarily awaits its full distension by urine; in cystitis, the smallest accumulation is expelled with urgency.

Obviously, this is also a wise and beneficial arrangement. Rest, as we shall see, is one of the most important means whereby the inflammatory process may be met and subdued; and intolerance of function is of use, not only to suggest the propriety of rest, but also to compel its adoption. How lamentably destructive might not inflammatory change prove, were it unaccompanied by pain and increased sensibility!

(b) *Disorder of Functional Activity* invariably attends, more or less; its degree usually keeping pace with the progress of the disease. On subsidence of the inflammatory process, function is resumed; but when resumed, it is for some time still perverted, and slowly returns to its pristine and normal character, sometimes never regaining that—quite.

The stomach, inflaming, fails in its duty as a digestive organ; the kidney, as uropoietic; the brain, as an organ of sense and intellect; a muscle, bone, or joint, as an organ of locomotion; an artery or vein, as an organ of circulation; an eye or ear, as an organ of special sense.

Extension of the Inflammatory Process.

The inflammatory process may extend, 1. *By Continuity* of the inflaming texture; and certain textures are peculiarly prone to such extension—as the skin and mucous membrane. It is no uncommon thing to find an inflammatory affection of the skin, the result of injury, and at first a mere pustule, spreading continuously into an erysipelas. And an inflammatory process, at first limited to one portion of mucous membrane, often quickly spreads over a large space of the same tissue; from the fauces to the larynx, trachea, bronchi, and bronchiæ; from the pharynx to the œsophagus; from the stomach to the bowels; from the vagina to the urethra; from the urethra to the bladder.

2. *By Contiguity*; the texture secondarily involved not being continuous, but connected by juxta-position; and usually, the more loose the intervening texture, the greater the facility of extension. In neglected phlegmonous erysipelas, the disease commencing in the surface may soon reach bone and joint; an inflammatory affection of a mucous membrane often induces abscess on its exterior, as in the case of the urethra; an attack originating in the envelope of an organ, may pervade the organ itself. In such cases, the connection by blood-vessels, nerves,

and lymphatics, common to all the textures implicated, may serve to explain the extension of the process. But we meet with examples which cannot be accounted for in this way, as, *e.g.*, when the pleurisy excited by a broken rib affects not only the pleura adjacent to the injured bone, but also the pulmonary pleura with which it is in contact; or when a local peritonitis, caused by ulceration of the intestines, excites structural change terminating in adhesion with some distant portion of the serous surface with which it merely comes in apposition. In such cases, the inflammatory products act as a source of irritation to those parts with which they are contiguous; an explanation which may also serve to account for the extension of inflammatory affections on continuous surfaces in one direction rather than another.

The more rapid the attainment to the suppurative crisis in the part first attacked, the more likely is the disease to extend, and that quickly, to those in the neighbourhood; for its advance is unopposed by attendant change of structure. In the formation of an ordinary acute abscess, the progress is gradual; and the central portion is surrounded not only by serous accumulation, but by a dense fibrinous mass filling up, and as it were fortifying the previously loose tissue, and exerting a restraining influence on both the extension of the disease and the diffusion of its products. In phlegmonous erysipelas, on the contrary, the crisis is much more speedily attained, there is no such salutary barrier, and the surrounding texture remains open and defenceless. The consequent mischief is great and often irreparable. The limiting fibrin is either not formed or not retained, the affection being of an asthenic kind from the first.

3. Extension of the inflammatory process may be *Remote*—that is, the part secondarily involved is at a distance from the original site of disease; and the intervening parts are unaffected. This may be effected by 1. *the Blood*. This fluid, as formerly seen, emerges from the inflaming part, changed, as from a laboratory; and circulating thus altered to other and distant parts, may itself become the exciting cause of perversion there. In this way some would explain the metastases which are so frequently met with in gouty and rheumatic inflammatory affections. And the purulent formations—in other words, unusually rapid and acute abscesses—occurring in connection with certain forms of phlebitis, at a distance from the affected vein, may be in like manner accounted for. 2. By the agency of lymphatic *Absorption*. A part is inoculated by a hurtful virus; an inflammatory process results in the injured part; besides, a portion of the virus has been carried on by absorption, and becomes arrested in the first lymphatic gland, there exciting an inflammatory process which terminates in suppuration—while, it may be, the conducting apparatus is itself almost or altogether unscathed. Thus, a poisoned wound of the finger causes first superficial paronychia, and then glandular abscess of the axilla, sometimes without much apparent affection of the intervening lymphatics. When they suffer, the case is plainly an example of continuous as well as of remote extension. 3. By *Nervous agency*. By this, sympathy of function is maintained between distant parts in health; by the same agency, sympathy of disorder may be established in disease. Thus, morbidly as well as

ordinarily, the uterus is found sympathising with the mamma ; one eye with the other ; and internal organs, such as the lungs or duodenum, with extensive ulcerations on the surface.

Inflammatory Fever and appearances in the Blood.

But the disease extends not only from one part to another ; it also spreads from a part to the system. It seems not unreasonable to suppose that the local irritation may be extended through the nervous system to the centre of the circulation, while heated blood constantly flowing from the part warms up the whole mass of that fluid ; and that so constitutional disorder—or inflammatory fever—is established.

The premonitory symptoms of coldness and shivering are usually very decided, but not of long duration. They are succeeded by a stage of re-action, in which the accelerated and hard full pulse, thirst, and increased heat of surface, are so great in comparison with the other symptoms, as to indicate excitement of the sanguineous system as the most prominent characteristic of this type of fever. It presents few fluctuations or remissions ; its accession and crisis are usually very distinctly marked, the latter being accompanied in the great majority of cases by sweating ; and the return to health is usually satisfactory and rapid, when the cause of the disease has ceased to act. It is to be recollected, however, that there is no absolute line in nature between this and any other type of fever ; and that, moreover, the purest inflammatory fever, when protracted beyond a certain period, is sure to undergo alteration into some other and more fatal type of febrile disorder.

Inflammatory fever begins with symptoms of depression ; the patient feeling much discomfort, and yet unable to specify his ailment. Then a rigor, or fit of shivering occurs, followed by a sensation of much heat over the whole surface. This is the harbinger of re-action ; the mark—and a practical one of great importance—that the circulation has shaken off the temporary depressing influence, and is rousing itself into energy of action. Then it is that remedies are of most avail. That opportunity, well taken advantage of, is usually at once decisive of a fortunate issue ; but permit it to pass unemployed, and the same remedies, augmented even tenfold, may fail to avert disaster.

It is convenient to consider the disorder of the general frame according to its Systems.—1. *The Nervous.* There are aching dull pains in the loins and limbs ; there is restlessness, and with much discomfort a variety of posture is practised in vain search for ease ; both the will and the power of exertion are diminished ; anxiety, or foreboding of evil, is felt, and its expression is given by the features ; the head generally is hot ; at first, special sensation is exalted ; by and by, the intellectual functions are more or less disturbed ; ultimately delirium is established, and coma may ensue ; the face is flushed, the eyes suffused, the skin hot and dry.—2. *The Vascular.* Disorder here is chiefly indicated by the pulse. It is increased in frequency—ranging from 80 to 130 or more ; and the heart's action is proportionally rapid. The pulse is hard, rolling like a cord below the finger, and yielding but little to its pressure ;—often communicating the sensation of a thrill or jar. There is

increased fulness, as if the vessel were itself enlarged, and held a larger quantity of blood at each impulse ; the heart is acting not only more rapidly but more powerfully than in health ; the circulation is truly accelerated.* Such are the ordinary characteristics of the inflammatory pulse ; frequency, hardness, thrilling, fulness. The three first are seldom if ever absent ; but the fourth may be wanting, and the pulse may be small instead of full. This modification is chiefly observed during serious inflammatory affections of important internal organs ; more especially those situated in the abdominal region. And hence it is in practice sometimes termed the abdominal pulse ; the artery resembling a hard thrilling thread, rather than a cord. This pulse always exists in connection with great nervous depression, and debilitated though rapid cardiac action ; to which circumstance its smallness is probably due. In affections of the brain, on the other hand, producing coma, the pulse is commonly slow and full. There are idiosyncrasies also to be taken into account. The pulse may be naturally slow or rapid—50 or 90 ; and this must be allowed for, when previous inquiry has satisfied us that the patient is the subject of such peculiarity.—3. *The Respiratory*. Respiration is quickened ; the breath seems to be hotter than usual ; and an oppression is felt in the chest.—4. *The Digestive*. The tongue may vary in its appearance. It may be loaded, white, and moist ; or the edges and central tip may be red and dry ; the latter is probably the more frequent combination. In peculiar, and as they are called typhoid cases, where depression is great, and the nervous system much engaged, the tongue is dry, and of a brown colour in the centre. There is thirst, usually very troublesome, with nausea, loss of appetite, sometimes vomiting, and often tenderness of the epigastrium ; the bowels are constipated.—5. *The Secerning*. The secretions and excretions in general are materially diminished. The bowels, we have seen, are constipated—mainly from want of mucous secretion from their lining membrane ; the skin is hot and dry ; the mouth is parched ; the urine is scanty, high coloured, generally acid, sparingly aqueous, the urea and uric acid increased, the chlorides diminished or absent.—6. *The Nutritive*. Digestion is interrupted ; so is assimilation ; as the fever advances, so does emaciation ; and strength is more and more prostrate.

Such are the ordinary symptoms of inflammatory fever. The more intense the local process, and the more important the part involved, the more rapidly and formidably are they developed. They also vary according to the natural temperament of the patient. They may remit ; nay, often do ; at one time increased, at another mitigated ; exacerbation usually vesperal, remission matutinal. But they never undergo an actual intermission ; therein resembling the local symptoms of the malady.

Having reached a certain point, the symptoms may decline, like the local change which caused them. The pulse becomes less hard, less full, and less frequent ; the heat and thirst diminish ; strength and appetite begin to come again ; and the secretions re-appear. Not unfrequently,

* Mere frequency of pulse is not a proof of increased rapidity of circulation ; the heart's action may be weak as well as quick ; it often is so (but not inflammatorily), propelling the blood more slowly than in health. To expedite the flow, it must act not only more quickly, but more forcibly than in the normal state.

such amendment is ushered in, if not partly caused, by sudden and great exaltation of the secernent function—so marked, as usually to be termed *critical*. The patient is bathed in a profuse and sustained perspiration. Or diarrhoea occurs. Or the urine flows copiously; more aqueous; less concentrated; at each evacuation less and less coloured; containing chlorides, and an increased quantity of sulphuric acid; and, on cooling, letting down a large quantity of sediment—resembling brick-dust, and hence termed *lateritious*—composed chiefly of urate of ammonia, more or less coloured by euroerythrin and pink pigment.* Hence the state of the urine comes to be important to the practitioner; scantiness, concentration, and want of deposit, denoting persistence of the symptoms; profuse flow with copious sediment, declension. Sometimes a discharge of blood takes place; by the rectum, the urethra, the mouth, or the nose—according to the part affected. This is not unlikely to frighten the patient and his friends, and may alarm the practitioner. But the latter is highly culpable who, from such alarm, rashly interferes to stop the flow. His duty is to watch the event; withholding his hand, unless the bleeding should threaten to prove excessive. Such critical evacuations and discharges are usually preceded by rigor and exacerbation (then, too, let the practitioner wait, and beware of officious meddling), and are followed by marked relief of all the symptoms.

But these symptoms of inflammatory fever, instead of declining, may advance; and, combining persistence with intensity, may cause a fatal result. Protracted exercise of a muscle ultimately exhausts the irritability of that muscle, which then ceases to obey its stimulus. In like manner, excitation of the general system, if both great and prolonged, is certain to wear out the powers of that system; and the patient sinks in consequence.

Or the symptoms neither simply decline, nor simply advance, but undergo change. 1. On the occurrence of suppuration—profuse and long-continued, or in an internal and important organ, or in a patient previously much debilitated—they change their character; assuming the form of *Hectic* fever. 2. On the occurrence of mortification over a large surface, or in an internal and important part, or in a worn frame, they change to the *Typhoid* form; tending to fatal collapse. 3. Or the local process, showing plainly what is termed the asthenic type, and hurrying on to serious suppurative and ulcerative disintegration of texture, the accompanying fever may exhibit more or less of the characteristics of all the types here mentioned—constituting what is termed the *Irritative*.

The blood, we have seen, undergoes serious change in the inflaming part; and by a constant succession of such changes, the whole fluid comes at length to be altered almost to the same extent as that portion of it which has just emerged from the seat of local disease. In a case at once decided and advanced, draw blood directly from the inflaming part, as well as at a great distance from it; the two fluids will be found exhibiting nearly the same characters of change; and, as already said, both will shew an increase of temperature beyond the standard of health—which general increase has, no doubt, much to do with the heat and feverishness just described. Coagulation of the drawn

* Parkes on the Urine in Health and Disease.

blood is slow, and results in a clot unusually firm and dense ; surrounded by serum, which is apparently increased in quantity, because thoroughly squeezed out of the solid matter. In the clot the fibrin and colourless “lymph globules” occupy the upper part ; the red corpuscles sinking to the bottom, in virtue of their greater natural specific gravity, their proportionately diminished number, and their increased tendency to cohesion.* The pure fibrin and colourless corpuscles, therefore, keep the surface of the coagulum, and present a yellowish hue ; and constitute the “*Crusta phlogistica*,” or “*Buffy coat*.” But the complete separation of the red corpuscles from the fibrin not only leads to the formation of the buffy coat ; it permits complete contraction of this fibrinous layer by expression of this serum. The contraction being centripetal, the circumference of that layer gradually leaves the sides of the recipient vessel ; the weight of the general clot at the same time drags on the centre, occasioning a hollowing of the fibrinous surface ; and the blood is said, in consequence of the form assumed, to be both “buffed and cupped.” The coagulum so formed is usually of the shape of a cone, truncated at the top ; with its broad base often adherent to the bottom of the vessel. When slightly buffed, the clot is usually cylindrical and floating.

Such are the appearances of inflammatory blood drawn in mass. If it be taken in a full stream, into a deep vessel, and exposed to cold, these appearances are favoured : a tiny trickling stream, a shallow vessel, and exposure to an increased temperature, are on the contrary unfavourable to their occurrence. Also, at different times of bleeding, and even of the same bleeding, such characteristics may vary ; the portion first drawn may be neither buffed nor cupped, while that which flows last is both, and intensely so. When the blood has the buffy coat but slightly developed, it is said to be *Sizy*.

These characters appear to result not only from the proportionate increase in the fibrin of inflammatory blood, but also to be due to an increased tendency to adhesion of the blood corpuscles to each other, which are seen by the microscope to collect themselves into an open network of rouleaux, or form compact globular masses ; clinging together with great tenacity, and “heavy as lead,” sinking to the bottom, while the granular or reticulated appearance thus imparted to a thin layer, may be recognized on a slip of glass or a lancet point, when viewed only by the naked eye.

It must ever be remembered, however, that the buffed appearance is not, of itself, a sure indication of the inflammatory process. It may be



Fig. 7.

* “Observations on the State of the Blood and Blood-vessels in Inflammation,” by T. Wharton Jones, F.R.S., *Medico-Chirurg. Transactions*, vol. xxxvi. 1853. “On the Early Stages of Inflammation,” by Joseph Lister, Esq., F.R.C.S., *Philosoph. Transactions*, Part ii. 1858. “The Cause of the Coagulation of the Blood,” by Benjamin W. Richardson. London, 1858.

Fig. 7. Microscopic diagram shewing the reticulated arrangement of the corpuscles in inflammatory blood.—WHARTON JONES.

seen in blood drawn from chlorotic,* as well as from pregnant females ; from patients affected by sanguineous plethora, or from any one in whom circulation and change of structure have been much accelerated, as by violent exercise ; in patients suffering from albuminuria ; and, in the horse, as the normal state of the blood. On the other hand, we know that an active and most serious inflammatory affection may be present, while in the blood the ordinary inflammatory characters can be but faintly traced. These are but the exceptions ; yet exceptions all important to the practitioner ; inasmuch as, while the presence of the buffy coat alone will not warrant him in reckless expenditure of blood, neither will its absence, during urgency of other symptoms of inflammatory disease, be in itself any sufficient reason for withholding active remedies.

Again :—the buffed and cupped appearances vary according to the texture and organ involved. The inflammatory process affecting the skin in erysipelas, or the fibrous tissues, as in rheumatism, invariably produces a high degree of change ; while a much more formidable disorder may be advancing in the brain substance, and be unaccompanied by any such change in the blood. The inflammatory process, occurring in a part richly endowed with lymphatics, gives much of the buffy coat ; and its presence seems to be directly in proportion to the abundance of the development of these vessels in the part implicated.

Causes of the Inflammatory Process.

These have been divided into, 1. Predisposing ; 2. Exciting ; 3. Maintaining ; 4. Proximate. But as the last is really the change in the nutrition of the part itself—the phenomena of the disease, already considered—we have to do only with the three first.

I. *Predisposing Causes.*—These may act through the general system, or directly on the part itself, or in both ways. 1. *Unwonted excitability* may reside in a part or in the system, by exaltation of the nervous function. When occurring locally, it manifestly predisposes to the inflammatory process, whose first movement, apart from the direct influence produced on the cell structures of the part, consists in an impression made by the exciting cause on the nutrition of the part through the medium of the nervous system. By strained use, for instance, the eye has its nutritive and nervous activity so exalted, that from even a slight cause an attack of ophthalmia is favoured.

2. *Plethora* may be general or local. The former—either the result of original temperament, or casually induced, as by excess in diet—may, by the abundance of material which it supplies, afford increased

* Arrangement of fibrin to constitute the buffy coat, does not depend so much on actual increase of the fibrin, as on its proportional excess over the red corpuscles. In chlorosis, the latter are very much diminished in quantity, while fibrin may be abundant.

The simply excited condition of the circulation, with or without organic change, is not capable of establishing such proportional excess of fibrin ; a local inflammatory change must be present. That is the laboratory whence the change issues ; without it, as in ordinary continued fever, fibrin is deficient both actually and relatively.

supply of this to any part competent to assimilate it, and so facilitate the induction of inflammatory change. But it is probable that it does not act so often, or so much, in this manner as is generally imagined. There can be no doubt, however, that local plethora—that is, determination of blood to a part—however induced, predisposes and that strongly to the inflammatory process; whose first movement, as we have seen, after the nervous impression, is this very sanguineous determination. Increased and sustained use of a part—as of the eye, kidney, liver—in the very act of heightening its functional activity, brings to it a determination (*i.e.*, an increased supply) of blood; and thus doubly predisposes to inflammatory access. This is also well seen in the tendency to inflammatory affections in and near the junction of the epiphysis and shaft of the long bones during the period of adolescence, and in the uterus and ovaries in females during menstruation. It may be further observed, that local plethora, with the disposition to inflammatory disorder which it engenders, has an important relation to age. In infancy and childhood, the brain is peculiarly liable to suffer; in adolescence, towards puberty, the pulmonary organs; in the adult, the abdomen.

3. *Debility*, general and local. This is by far the most prolific class of predisposing causes. Vitality—or “vital power”—resides inherently in the cell elements of the tissues which compose the system, whereby morbid change resulting from the application of an exciting cause is either resisted successfully and averted, or, when commenced, is controlled and modified. The greater the impairment of this vital power, the more prone are part and system to the occurrence of disease. Inflammatory disease thus often predisposes indirectly to inflammatory disease. A part inflamed, we formerly saw, has its vital power impaired, and may never wholly recover in this respect; long it remains weak, and consequently predisposed to recurrence of the disease; sure to be overcome by even a slight exciting cause, whose stimulus it could previously have borne with impunity. Bad food, air, and clothing; intemperance; the presence in the blood of poison—as the syphilitic; excessive and habitual exertion of mind or body; excessive and habitual evacuations; previous disease, and often the treatment necessary for its removal—are other familiar examples of causes of debility, and consequently of predispositions to inflammatory change.

Predisposing causes may be combined. An eye, for instance, may have a determination of blood towards it, at the same time that its nutritive activity has been exalted by unwonted exercise of function; by a previous inflammatory attack, too, the part may be weak; and by confinement, bad air or food, sustained mental exercise, or all together, the frame may be debilitated. A part thus unfortunately situated can scarcely avoid becoming seriously inflamed, under the influence of renewed excitement.

II. *Exciting Causes*.—Those which directly induce the morbid process. The more prominent may be shortly mentioned in detail. 1. *Ordinary Irritants*; as acids, alkalis, acrid salts, alcohol, turpentine; acting by direct stimulus, on the elementary structures, and on the nerves and blood-vessels of the part. 2. *Wounds*, and other mechanical injuries,

require a certain amount of the constructive results of the inflammatory process for their cure ; these, apparently, are sufficiently induced by the *direct* irritation of the tissues, occasioned by the wound ; but not unfrequently, by the excitement of *indirect* irritation set up through the medium of the nervous system, suppuration—a destructive result—is established ; and then healing is delayed, until the process shall have again subsided from the inflammatory excess. 3. *Lodgment of foreign bodies.* A wound, under any circumstances, is not unlikely to inflame instead of healing ; but if it contain extraneous matter, which is not removed, the attack is inevitable. 4. *Pressure*, in like manner, is a prolonged stimulus ; if slight, absorption may be chiefly produced, by the interference it occasions to nutrition ; if severe as well as sustained, the cellular, nervous, and vascular elements of the texture become unduly stimulated ; the inflammatory process is produced, sometimes attended by constructive enlargement, sometimes advancing to suppuration, ulceration, or even gangrene. 5. *Heat* is a most powerful agent. Extreme, it at once extinguishes life, and reduces the part to the condition of a dead eschar ; applied more leniently, its destructive effects are slight or limited ; it proves a stimulus to the textures, and to their nerves and blood-vessels, inducing an inflammatory process which may vary from its simplest to its highest grades. 6. *Cold*, considerable and sustained, may act either on the part itself, whose temperature is diminished, or on some other part at a distance. (1.) At a distance. Cold is applied to the feet and legs, or to a large part of the general surface. Circulation is enfeebled there, as shewn by the pale and shrunken integument. The blood, instead of being equally distributed over the body, is pent up within, and overloads the internal organs ; one of these—the lungs, for example—is more burdened, or more susceptible than the others ; it has obtained the first vascular move for the inflammatory process ; and that process, still further determined through the reflected nervous influence of the peripheral irritation, produced by the chilling of the extremities, advances accordingly. (2.) On the part itself ; not by the first effect of cold, but by reaction following upon this. While decrease of temperature is maintained in the part, comparatively little blood circulates there, its nervous influence is depressed, and all vital power is enfeebled. On withdrawal of the cold's influence, blood rushes back to the comparatively empty vessels ; nervous agency is restored, with a tingling sensation ; vascular turgescence is at once established, and that in a part whose vital power has just before been impaired, and which, consequently, is but little able to resist or control the change so commenced ; this advances comparatively unopposed, and the part may fall an easy prey. The onset will of course be more rapid and severe, if, besides withdrawal of the frigorific agent, heat, friction, or other stimuli, be at the same time applied. Nothing can be more injudicious, yet there are few practices more common ; grave disorder is rendered inevitable. 7. *Atmospheric change* may prove either predisposing or exciting ; the former, when exposure is general and habitual—often associated with habits of intemperance ; the latter, when exposure is partial and sudden. It is familiar to all how often inflaming throats, eyes, lungs, and joints, are attributable to casual exposure to atmospheric vicissitude. The *modus*

operandi is similar to what has just been explained in regard to cold. 8. *Undue exercise of function*, in like manner, may either predispose or excite; according as it is habitual, or casual and excessive. It operates by inducing local plethora, at the same time exalting nutritive activity; not only inviting the change, but giving the first move in its advance. 9. *Vitiated secretion* acts as a direct communicator of irritation; (1.) From one part to another, in the same patient; as tears to the cheek, or discharge from the rectum and vagina to the cleft of the nates. (2.) From one patient to another; as gonorrhoeal discharge from the urethra, acting on the conjunctiva, or on the genital organs. (3.) From the lower animals to man; as in the case of the vaccine virus, and glanders. 10. *Retention of the ordinary secretion* of an organ tends to inflammatory access; retention of urine may be followed by cystitis; distention of the lachrymal sac by suppuration, and the establishment of fistula lachrymalis.

The inflammatory process, when it occurs without any apparent or assignable exciting cause, is said to be spontaneous or *idiopathic*.

III. *Maintaining Causes*.—When any *cause* of the inflammatory process continues to act after the commencement of the morbid conditions which characterize its access, that cause, whether predisposing or exciting, then becomes a maintaining cause, by which the disease is not only prevented from spontaneously abating, but positively aggravated in point of extent, violence, and intractability. The lodgment of a foreign body beneath the eyelid serves as a good illustration of this important practical fact. It first acts as an exciting cause of the inflammatory process, and, until it is removed, continues both to excite the disease afresh, and also to prevent any treatment, however active or sustained, being of the slightest avail; but no sooner is this maintaining cause removed, than the inflammatory symptoms abate, repair ensues, and that almost without the use of treatment of any kind.

Duration and Character of the Inflammatory Process.

Generally speaking, rapidity of progress and intensity of disease are phrases nearly synonymous. Sometimes the process is very gradual in its advancement; requiring, as in the example of the vaccine pustule, formerly adduced, eight or nine days for its completion; and many inflammatory changes are yet more protracted. But after a wound, or other mechanical injury, the process is usually complete, and suppuration commencing, by the second or third day. One day, or less, suffices for the occurrence of suppuration in many cases of phlegmonous erysipelas. And the secondary abscesses attendant on phlebitis, there is every reason to believe, are often begun and completed within a few hours.

Progress varies, as to time and character, according to—1. *The Structure* of the part affected. The more highly organized, vascular, and endowed with nervous energy, the more rapid and intense the change. 2. *Situation* of the part. The nearer to the centre of circulation, the more disposed to rapid and acute disease. 3. *State* of the part. When vital power has been impaired, by previous disease or other debilitating

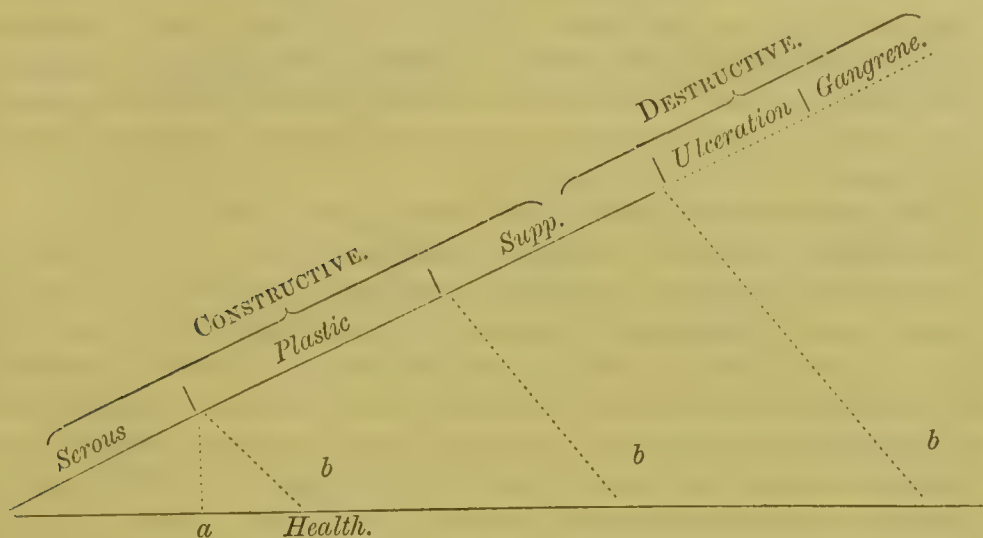
cause, the part is prone to undergo inflammatory changes ; and these invariably tend to a speedy and destructive issue. All adventitious structures, also, being of low organization and vitally weak, soon yield before the inflammatory process. 4. *Temperament* of the patient. The sanguine temperament favours both rapidity and intensity ; in the nervous, disease is readily induced, but is prone to assume the mild and chronic form ; the phlegmatic is unfavourable to occurrence, rapidity, and intensity. 5. *Diatheſis* plainly modifies both occurrence and character ; as is exemplified in scrofulous and rheumatic affections. 6. *Age*. In childhood and infancy, the attack is both likely and acute ; often its progress is fatally rapid. In adolescence, its general character is also acute ; easily induced ; but not so apt to end disastrously, there being usually enough of vital power to maintain control. Then too, by reason of habitual activity in the nutritive function, the inflammatory process is usually attended by copious product of the more solid kind ; either plastic or tubercular, according to the power and disposition of the system. In adult life, disease is probably less easily induced, but is generally acute, and is apt to prove formidable by intensity. Old age is more prone to passive congestion ; and when the inflammatory process does occur, it is commonly languid and slow, and tends to an unfavourable result ; both part and system being lowered in vital power. 7. As regards *Sex* ; Females are constitutionally prone to inflammatory affections ; but males are more exposed to casual predisposing and exciting causes ; the latter sex, too, may be considered as pre-eminently liable to disease of an acute and sthenic type. 8. *Habits* of intemperance predispose to inflammatory disease ; rapid, and acute, but often asthenic, and apt to end injuriously. Sedentary habits are also favourable to accession ; but usually the disease is more under control. Privation—involuntary or assumed—is unfavourable to accession ; and the disease is usually chronic or asthenic. 9. *Atmosphere and Season* are not only important predisposing causes, but also materially influence progress and type. A foul atmosphere impairs the vital power, and so favours the onward progress to a rapid and unfavourable issue. In like manner, an unhealthy season fully vindicates its title to the name, by its subtle and sinister influence on inflammatory as well as other forms of disease ; as the history of erysipelas, especially when epidemic, abundantly testifies.

RESULTS OF THE INFLAMMATORY PROCESS.

Resolution.

This is the most favourable result, and that to which treatment is usually directed. But let it never be forgotten, that such treatment must be early as well as suitable and active ; inasmuch as this result can only be hoped for while the process is yet short of the suppurative stage. That reached, true Resolution—that is, complete restoration of the part, as regards both structure and function, to its original and normal state—is scarcely possible.

The accompanying diagram, though both rude and fanciful, may



assist to make this matter more plain. It will also illustrate the opinion held as to the gradual formation of the inflammatory crisis.

The commencement, not inconsistent with healthy structure and function; but sometimes, by persistence, injurious. The second stage, a departure from true health, and pressing on to true disease; the consequences sometimes salutary, in local emergencies—as in wounds and ulcers; but, in general, prone to evil by alteration of both structure and function. The third stage essentially morbid; and although attended with rapid cell-production, utterly at variance with healthy structure and function. The higher results, which follow the suppurative crisis by continuance of the disease, are invariably subversive of function, and destructive of texture; and, consequently, are pernicious—unless when it has become essential for the wellbeing of the whole, that the part so affected shall be destroyed.*

Resolution may be gradual or sudden, spontaneous or artificial, imperfect or complete; the more early and slight the morbid change, the more likely is the resolution to be speedy, spontaneous, and perfect.

When sudden, the term *Delitescence* is commonly employed; denoting an occurrence favourable in itself, but invariably associated, in the mind of the experienced practitioner, with a suspicious prognosis. Were the delitescence effected simply, and there an end, the immediate benefit derived would be without alloy. But experience tells us, that the abrupt and sudden disappearance of advancing inflammatory disease in one part, is often, if not usually, followed by the appearance of similar disorder elsewhere. And, as we have no guarantee that the change shall be to an equally harmless locality, such change must at all times be a matter of suspicion, and often of danger. The disease, for example, may leave one part of the skin, and suddenly appear in another portion of the

* The dotted lines denote the process of Resolution, or the return to health—*a*, sudden and direct Resolution, or Delitescence. *b, b, b*, lines of gradual Resolution from various points of the ascending process. The suppurative stage having been attained, true Resolution cannot occur; that is to say, a certain amount of change of structure must be permanent.

same tissue. Or it may quit an internal part, and shew on the surface. In the one case, probably no harm is done ; in the other, a decided advantage accrues from the change. But, on the other hand, delitescence of an erysipelas is often followed by establishment of the inflammatory process in a serous or mucous membrane, or even in the substance of an important internal organ ; and such change may be—nay, often has been—fatal.

The process which effects subsidence of the original disease, and establishment of the new, is termed *Metastasis*.

Metastasis, however, may be only apparent. Often, disappearance of an external inflammatory process is quickly succeeded by the super-vention of one that is internal ; and the latter is rightly held related to the former, as effect to cause. Yet, not unfrequently, we may have the two circumstances contemporaneous or nearly so, with their relation reversed ; the internal disorder proving the cause of the subsidence of the external—the less becoming merged in the greater malady.

Sometimes we find that, as the new inflammatory affection subsides, the old external disease reappears, and cases occur in which fluctuations between the external and internal seizures are repeated over and over again. The possible occurrence of an artificial metastasis of the morbid process from internal to external parts leads to the employment of counter-irritation, as it is called, in the treatment of internal inflammatory disorders.

Resolution being about to occur, the part regains its functional activity ; the dilated vessels begin to recover their wonted tone and calibre ; and circulation revives from the impending or actual *remora*. The red corpuscles within the marginal area of stagnation resume their individual distinctness ; and the agglomerate masses, of both red and colourless corpuscles, blocking up the vessels, first oscillate, and then move steadily on into the general circulation. The local determination of blood ceases ; and the inflammatory changes begun in that fluid are recovered from. Absorption comes actively into play ; and the extra-vascular product is more or less rapidly removed—the more rapidly the more serous its character. Ultimately, the balance of healthy nutrition in the part is restored, the supply of blood brought down by the arteries not exceeding the amount required to meet the waste of texture ; and normal change and exchange, as well as functional activity, are resumed.

Such resolute change is marked by a corresponding alteration, equally favourable, in the local symptoms. The pain and heat are the first to subside ; then the redness ; ultimately the swelling more or less gradually disappears. Should the constitution have begun to sympathize, the fever will be found to decline ; and critical excretions will probably occur from the skin and kidneys.

When the inflammatory process has been slow in its advance to the resolving point, as well as in its subsequent declension, resolution will probably be imperfect. Time has been afforded for the constructive results to attain a mature form, and to be less amenable to absorption than when of fluid or semifluid consistence. There is an obvious risk, consequently, of a certain change of structure either proving altogether permanent, or long resisting the efforts of absorption.

II.—*Constructive Results.*

These attend on advance of the process ; and also persist, though to a diminished extent, during part of its decline. They may be serous, lymphous, or both.

1. *Of Serum* containing more albumen, and of higher specific gravity than in health. This attends the whole range of the inflammatory process, and, separately distinguished, is usually placed circumferentially. Occurring singly, it is the product of a minor degree of the change in the nutrition of the affected part ; and, as already stated, may be considered appropriate to the first stage.

It is seldom, however, that pure serum is found in connection with the inflammatory process ; it almost always contains a greater or less admixture of fibrin. And this indeed constitutes a distinguishing mark between inflammatory serum, and that which is the product of congestion, or of mere dropsical effusion. This serous fluid is no doubt derived from the vessels, either directly or indirectly ; directly, according to the doctrines of the Vienna school of pathology, in the form of *effusion* or *exudation* ; indirectly, according to the doctrines of Virchow and his followers, by the demands of the connective tissue elements, which, abstracting that portion of the fluid constituents of the blood which forms their *pabulum*, undergo rapid nuclear proliferation, attain maturity, break up, become fluid, and thus yield the sero-fibrinous product, which differs in its constitution, and more particularly in the amount of fibrin present, according to the rapidity, the nature, the extent, and the situation of the morbid process.

(a.) When the *serum* is produced in the *interior* of the part, it occupies the areolar tissue, and constitutes *Acute Œdema*. The swelling then varies according to the amount of product, and the nature of the recipient part ; if the latter be unyielding, tension ensues, with increase of pain and acceleration of the process onwards. But usually the surrounding textures are accommodating ; the swelling is found soft when compared with that of fibrinous character ; and yielding before the finger by temporary displacement of the serum, the part is said to *pit* on pressure. The pitting, however, is much less distinct in the *Acute* than in the *Chronic* or *Passive Œdema*, to be afterwards described.

(b.) The product may be from the *surface* of the part ; whence it flows harmlessly away, like the ordinary secretion in health—as in the case of inflaming mucous membrane. Or it accumulates within an internal cavity, as in the case of the serous membranes ; then constituting *Acute Dropsy* of the part ; the bulk, uneasiness, and disturbance to healthy function by pressure, varying according to the extent and rapidity of its formation.

Acute production of serum, whether in the form of *œdema* or *dropsy*, usually disappears by absorption soon after decline of the morbid process which caused it : herein, again, practically most different from the results of *Chronic Congestion*.

2. *Of Fibrinous and Plastic Results.*—These may occur separately from any serous product ; but more commonly with the serum, in the form

of sero-fibrinous fluid, or coagulated lymph; the latter term denoting the form presented by this recent inflammatory product when aggregated on free surfaces unmixed with serous fluid. These results may be regarded as the characteristic product of the second stage of the inflammatory process.

This copious fibrinous formation, which is observed in the textures of the part undergoing the inflammatory process, and also in the general circulation, is derived from the elementary structures of the part.* When the inflammatory irritation commenced, these structures became affected, and secondarily induced the changes described in the surrounding textures, vascular and otherwise. The effect observed in these elementary structures (connective tissue corpuscles) within the area of irritation, is the rapid formation of nuclear and cell elements, which, the disease continuing, as rapidly moult and are succeeded by other similar formations. This rapid disintegration of newly-formed cells produces, in the parenchyma of organs and textures, copious fibrinous collections combined with the accumulation of more or less serum, partly due to the same cellular source, partly to the escape of the serosity of the blood from the vessels blocked up and obstructed by the compact agglomeration of their corpuscular elements. In the inflammatory affections of mucous membranes, again, the cell formations, instead of accumulating along with the serum, are discharged from the free surface in the form of mucus globules, more or less altered from their normal constitution.

(a.) This fibrin, containing in it some of the cell elements which have been rapidly formed by the connective tissue, may exist on the *surface* of the part; as on a serous membrane, or on the margins of a wound. Here the serous fluid having trickled away, the fibrin remains, in the form either of a continuous film, or of masses more or less detached; at first transparent, afterwards becoming yellowish, and somewhat opaque. Should the inflammatory process progress slowly, or soon subside,

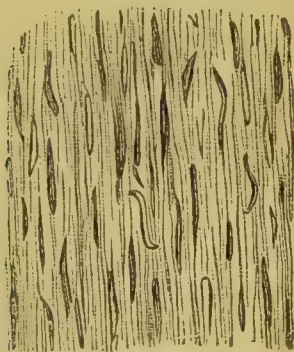


Fig. 8.



Fig. 9.

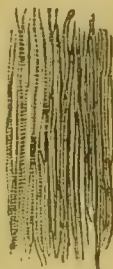


Fig. 10.

absorption finds the sero-fibrinous fluid, fibrin, and cell elements quite amenable to its play; and they are removed. But if the inflammatory process is rapid in its progress or persist, absorption cannot take place

* Cappie on Inflammation. Edin. Med. and Surg. Journal, Jan. 1854.

Fig. 8. Nuclei in the fibrinous product, developing themselves into fibres.—BENNETT.

Fig. 9. Fibro-plastic cells developing themselves into fibres.—BENNETT.

Fig. 10. Perfect white fibrous tissue.—BENNETT.

with the same rapidity as formation, and an opportunity is given for observing the process of organization which occurs in connection with it.

The lymph in which these changes are going on, when examined under the microscope, is usually found to possess two distinct elements. There is a filamentous basis, composed of very delicate threads, crossing one another in all directions. These enclose or entangle the second element, namely numerous cells, and corpuscles, of various sizes ; some nucleated, others nuclei ; and containing a greater or less amount of granules, and molecules, the results of cell-disintegration.

If this new material is to be re-absorbed, it is gradually softened and dissolved ; the cells either disappear, or burst and shrivel up ; and the whole mass becomes full of "granules of disintegration" (*Bennett*), which, attaining the fluid form, are readily taken back into the blood. When, on the other hand, tissue is formed, the cells or corpuscles (fibro-plastic) become elongated and spindle-shaped ; and at last assume the form and appearance of fibres, similar to those of white fibrous tissue.

At the same time, the new matter becomes supplied with blood and blood-vessels by the process of Vascularization. Blood corpuscles are seen coursing each other through the cell-structures, in new blood-vessels ; coming from, and again returning by, the vessels of the adjacent original structure. According to some, these new vessels are, as it were, self-formed in the plastic material. Nucleated cells send out radiating

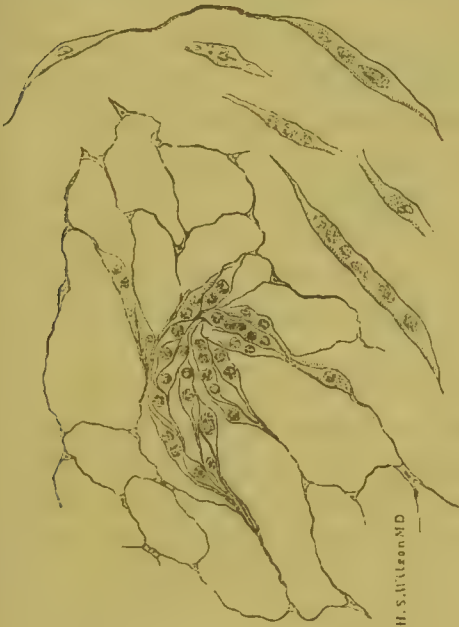


Fig. 11.



Fig. 12.

processes, which elongate, communicate with each other, and finally abut upon the older and previous capillaries. These then unite with the newly-formed vessels, which dilate, and begin to receive blood corpuscles from the older ones—in turn transmitting the circulation to others formed in the same way in the lymph beyond them.

It may happen that the hyperplastic product undergoes a higher organization than into fibro-plastic tissue, and is formed into texture

Fig. 11. Proliferation of the connective tissue of the inflaming pleura.—TURNER.

Fig. 12. Loop of a new vessel in organizing plastic product.—PAGER.

similar to that in the neighbourhood of which it was formed, *e.g.*, in connection with bone and periosteum—a process of change attributable to transformation of these nucleated cells.

Be it remembered, that the process of plastic organization is incapable of being carried on during occurrence and persistence of the third stage of the inflammatory process; the tendency of this being constantly and surely to the formation of pus (degenerate products of connective tissue proliferation), along with some disintegration of the primary structure. The pus and *debris*, however, are generally hemmed in and bounded by a margin of this plastic material, the inflammatory process having resulted in this less morbid degree of organization. This marginal new formation assumes, in many chronic abscesses, the form of a limiting membrane; which is then called “pyogenic,” as from its surface, after the abscess is opened, pus continues to be formed. When the fibrinous product forms on the free surface of a membrane, it is usually termed *False membrane*.

(*b.*) Fibrinous product may be produced, as we have seen, in the *interior* of the part; being mixed with fluid, it insinuates itself so as to fill up every minute space, and, along with the multiplication of cell elements, occasions enlargement. The cohesion of the old textures is, at the same time, generally impaired. If the affection be acute, the part is *soft* and pulpy, as well as swoln; a considerable proportion of serum being mingled with the fibrinous product.

If the affection be slight and gradual, *Induration* is found instead of softening; the serum having been absorbed, besides in all probability having been sparingly produced at first; and the connective tissue elements having reached a higher and more permanent organization.

The inflammatory process ceasing, so does excess of product; fatty degeneration of the cell elements takes place, and absorption then busies itself in attempts to clear away what has been already heaped up; and in this it may often be materially assisted from without by the hand of the practitioner.

(*c.*) The new cell formations and collection of fluid may be *both on the surface and in the interior*; for instance, into the texture and on the exterior of a serous membrane; or on the surface of such a membrane, and into the parenchyma which it invests. The result is a combination of the changes described in the two preceding sections of this subject.

Thus we see that the hyperplastic change or proliferation of elementary structures, which is the essential characteristic of the inflammatory process, varies according to the grade, the site, the extent of the disease, and the state of constitution and circumstances of the patient. (1) Softening and absorption with resolution may occur. (2) Organization of the nuclear elements—a constructive result—may be attained. (3) Or these may undergo fatty degeneration, with softening of texture. (4) Or imperfect and abortive organization occurring, suppuration follows.

To all plastic results, organized under even the lightest degrees of inflammatory change, a general rule seems to be applicable, *viz.*, that they are of an ill matured and imperfect organization, and, by consequence, generally removed in one of two ways; either by simple decadence and absorption,

analogous to the natural decay of tissue, on subsidence of the inflammatory process ; or—destructively—by a secondary accession of the same process, accompanied by either softening, or suppuration, and ulceration.

That inflammatory product is always the fittest for organization, which takes place under the slightest forms of the inflammatory process. By it wounds unite, bones knit, and arteries are consolidated. These salutary constructive changes are wholly incompatible with the presence of the third stage of the inflammatory process ; and are often but ill performed after its subsidence.

III.—*Suppuration.*

Pus is a yellowish-white, or greenish, opaque liquid ; resembling cream in consistence and general appearance ; varying in specific gravity from 1030 to 1040 ; and with scarcely any peculiarity of odour, when pure and recent. It separates partially, on standing, into a clear fluid—very nearly identical, in its chemical and other properties, with the serum of the blood—and into a sediment, which is shewn by microscopic examination to consist of peculiar corpuscles, usually with a greater or less quantity of finely molecular and granular matter.

The corpuscles of pus are generally spherical, varying a good deal in size, but most frequently about $\frac{1}{2500}$ of an inch in diameter. They have much resemblance, in size and general appearance, to mucus globules or to the white or colourless corpuscles of the blood—indeed, some observers declare them to be identical. Their cell-wall is somewhat opaque, but soluble to a great extent in dilute acids, which reveal a single, double, or treble nucleus.

In the partition of the nucleus, and in the comparative smallness of its size, pus corpuscles differ from the majority of cells found in the fibrinous products of the inflammatory process ; these latter being mostly either non-nucleated or single-nucleated, and the nuclei considerably larger than those of pus corpuscles. In fibrin, containing plastic cell-formations, also, the cells are in much smaller numbers than in pus ; and the connecting filamentous element which exists in the former is absent in the latter. In many cases, however, we can trace the one condition passing into the other.

Pus is not in itself corrosive as the ancients imagined, but bland and protective. The cell structures on the surface of tender granulations, for instance, are transformed into it ; affording them protection, and that effectually, until the superficial layer become converted into fully formed fibro-plastic tissue, constituting a cicatrix. But when “cribbed, cabin’d, and confined,” in the interior of a part acutely inflaming, it invariably induces increased irritation, and is accompanied with breaking up of those textures from the connective tissue of which it was originally formed.

Fig. 13. Corpuscles in pus. *a*, Corpuscles in grey hepatization of the lungs ; *b*, the same after the addition of acetic acid ; *c*, corpuscles in pus, from a subcutaneous abscess ; *d*, the same, after the addition of acetic acid.—BENNETT.

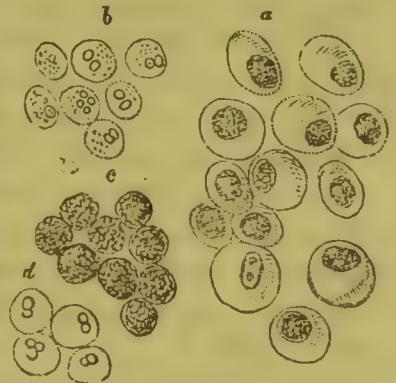


Fig. 13.

From what has been said, its formation will be seen to be due not to a chemical process, as at one time imagined ; nor to any melting down of the solids, by putrescence, as the name of *pus* ($\pi\upsilon\omega$) implies—but to a largely-increased formation, and as rapid degeneration, of the corpuscular elements of the connective tissue ; and hence a vital product, quite as much as the secretion of any other fluid containing cell-structures [the mucous, *e.g.*], only with this difference, that the one is the product of healthy, the other of morbidly increased cell formation.

As the inflammatory process approached the completion of its third stage, we saw that there was obstruction of the circulation of the blood, the presence of copious fibrinous product, the formation of innumerable cell-structures, more or less extravasation of blood by giving way of the altered vascular coats, and considerable breaking up of normal texture ; due to the formation and blighting of cells resulting from the hyperplastic changes in which the process consisted essentially throughout. At one time it was generally supposed that this purulent fluid was produced by a mere transformation of the liquor sanguinis, either within or exuded beyond the vessels, attempting cell-formation of the plastic grade, but failing to advance beyond the pus-corpuscle. Now-a-days we hold that the pus is virtually a formation, or secretion, from the cells of the primary connective tissue.

Pus, as we have described it, is of its normal character ; and, as such, is usually termed healthy, or *laudable*. But various circumstances may cause deviation from this state. A chemical action—perhaps the result of atmospheric contact—may be superadded to the vital process ; producing, by decomposition of the serum, hydrosulphide of ammonia, whose presence is indicated by an offensive odour, and by the blackening of silver probes brought in contact with the pus.

Pus may contain blood, either fluid or solid—besides containing the fluid and molecular *debris* of the suppurated part. It is reddened thereby, and found to contain blood discs, masses of coagula, and traces of broken-down tissue. It is then termed *sanious* or *grumous*.

In those of weak systems, it is often deficient in solid matter, consisting chiefly of a thin serum ; it is then termed *serous*. In the serofulous and cachectic, besides being serous, it often contains flakes or masses of a curdy appearance ; and to such pus the term *serofulous* is usually applied.

Sometimes it is impregnated with a subtle virus ; it is then said to be *specific*.

Or it may be variously mixed with the altered secretions from mucous, serous, or synovial membranes, and termed in consequence *mucopurulent* and *seropurulent*.

Several substances, met with in the organism, are apt to be confounded with pus. Fibrin which, within or without the blood-vessels, has been subjected for some time to the softening action of fluids ; the creamy softening of cancerous growths ; various fluids when intimately mixed, in certain proportions, with epithelium—these may resemble pus to the naked eye, nay, can hardly be distinguished by microscopic examination, *e.g.* in urinary deposits.

Pus may be formed on the free surface of a part, and be thence dis-

charged ; or in the interior of a part, and accumulate there. In the latter case, the immediate effect of suppuration varies according to the nature of the part. If loose and extensile, as is ordinary areolar tissue, the pain and throbbing often cease, or at all events diminish ; and the swelling becomes paler, soft, and fluctuating. If, on the contrary, the texture be dense and unyielding, like the osseous and fibrous, the inflammatory process, with its indications of tension, redness, heat, and pain, is much aggravated.

The result also depends on the preceding character of the inflammatory process. If this have leisurely advanced through its successive stages, in a healthy constitution, the pus is enclosed by the barrier of texture in which the inflammatory product has been of the plastic kind, preventing diffusion of the fluid into the surrounding parts—as in ordinary abscess. But if a rapid transition have been made from the origin to the acme of the inflammatory process, and that in an unhealthy subject, no fibrinous limitation is interposed ; the product is all aplastic ; and the pus is found infiltrated diffusely throughout the tissues, accompanied by destructive softening and breaking up of texture—as in phlegmonous erysipelas.

We have just seen that, on the occurrence of suppuration, the local inflammatory symptoms sometimes subside, sometimes become aggravated. A change also usually takes place in those of the general disorder, or inflammatory fever. Its first appearance was attended by a rigor ; and the same phenomenon usually indicates the approaching change. Usually, the rigor is followed by a marked remission of all the febrile symptoms ; which either continues until resolution is complete, or is superseded by the accession of febrile action of another type—the *Hectic Fever*. And this is sure to occur, when the suppuration comes from an extensive surface, is profuse and long-continued, more especially if occurring in an internal organ important in the economy ; or when the patient is of an already debilitated frame.

Hectic fever is distinguished by its frequent remissions and exacerbations, usually periodical, and occurring once, or sometimes twice, in the twenty-four hours ; by the sweating which follows the remission of its paroxysms, accompanied by great exhaustion and emaciation ; and also by frequent recurrence and long continuance of the febrile state, without that acutely marked disorder of the assimilative or nervous functions, which accompanies continued fever of similar duration.

Hectic fever is invariably connected with some severe organic disturbance, or change of structure ; and is the form of constitutional affection which most constantly accompanies profuse suppuration, especially in an important internal organ. It is under such conditions also, that it assumes its most characteristic aspect ; and has the most distinctly *periodic* exacerbations and remissions. When it is fully formed in the course of such local affection, the patient has usually at least one daily paroxysm or febrile exacerbation ; often preceded by chilliness, if not by shivering ; and attended by great heat of skin, flushing of the face, and burning sensations in the palms of the hands and soles of the feet. The pulse is frequent, but irregularly so ; and usually subject to quick

excitement by exertion, emotion, food, or any other disturbing cause. It is scarcely ever hard and full, like the pulse of inflammatory fever, nor so small and compressible as that of the typhoid ; but holds a middle and variable place, in these respects, according to the degree of exhaustion of the patient, and the amount of febrile reaction. This state does not last more than a few hours ; and then subsides by a critical sweat, so profuse and exhausting as to be justly termed *colliquative*. Or the sweat may be superseded by diarrhoea ; which is even more dangerous to the system. The condition of the urine is similar to that of inflammatory fever, or any other condition in which rapid transformation of texture takes place. The tongue may be a little dry during the paroxysm, which is accompanied by great thirst ; but becomes moist again so soon as the fit is over. The eye is free from suffusion ; and flushing of the face is usually limited to a spot in the centre of the cheek, the colour of which contrasts strongly with the general pallor.

These febrile paroxysms occur almost invariably towards evening, reaching their height about midnight, and passing into the sweating stage early in the morning. The intervals, in the early stage of the affection, are not unfrequently free from fever. Occasionally, however, there are slighter exacerbations ; sometimes irregular in character ; often seeming to be determined by the taking of food. In the advanced stage, fever is nearly constant ; but evening exacerbations and morning sweats remain characteristic of it to the end.

Notwithstanding the great and constantly increasing emaciation—which may be ascribed to the loss of nutritive fluid, by the suppuration or other discharge—the appetite and assimilative functions are comparatively little affected ; at least in the less advanced stages of the disease. Sometimes, it is true, there are exceptions to this ; but it is when the assimilative organs are directly involved, as in many of those cases of hectic fever falling under the notice of the physician. In the ordinary forms of hectic, connected with external disease, the appetite continues ; and food is taken, during the remissions, with considerable relish. The tongue then may be natural in appearance ; or it may present a slight fur, with red edges ; often it is preternaturally clean and glistening, as if its mucous membrane were peeled off ; it is rarely much loaded ; sometimes, however, covered with white aphthous patches ; but never permanently dry and rough as in typhoid fever. The bowels are frequently constipated, as in other diseases implying protracted confinement to bed ; but, not unfrequently, they are natural ; or there may be diarrhoea, as just mentioned.

But exemption of the nervous centres from participation in the general disorder is, perhaps, a more striking character of hectic, as compared with typhoid, and even inflammatory fever, than almost any symptom yet mentioned. Throughout the whole course of the affection, the mind may remain perfectly clear ; not uncommonly, indeed, the mental faculties seem to be in an unusually vigorous and active condition, even when the body is very debilitated. In the intervals of the paroxysms, the patient usually procures sound and refreshing sleep ; and even when fever has become constant, the harassing watchfulness (*pervigilium*) of the typhoid is very rare. Sleep may, it is true, be light and frequently

broken ; but it is obtained in sufficient amount to preserve the cerebral functions in a state not far differing from that of health.

The duration of hectic may be almost indefinitely protracted ; especially when the intervals of the paroxysms are tolerably free from febrile excitement. When, however, the fever is constant, when sweating is excessive, and when suppuration is profuse, progress to a fatal termination may be rapid. Emaciation proceeds to the last stage ; the features assume a shrunk, withered aspect ; the eyes are sunk in the orbits ; all the bones are prominent ; the flushing subsides into a pallid leaden hue ; and the whole expression is that called, by old authors, the *facies Hippocratica*—the sure sign of approaching dissolution. Death is usually by pure exhaustion ; the pulse and respiration ceasing very gradually, and the mind often remaining unclouded almost to the last.*

Of course, this fever is found to vary in duration, intensity, and issue ; according to the nature and duration of the cause which called it forth. On the removal of the cause, recovery is often extremely rapid.

When pus is formed rapidly after the onset of the inflammatory process, and is diffused throughout the textures, from want of concomitant formation of fibrinous product, the injury, as already stated, is great ; by infiltration, softening, disintegration, and gangrene. The constitutional symptoms attendant thereon are not those of Hectic, but of *Irritative Fever*. In the part, advancing destruction of texture is preceded by spreading inflammatory change, of a rapid and intense kind. The disease tends to excite the system ; but its effect on texture, having a directly contrary influence—produces general typhoid depression as a result. It need not surprise us, therefore, to find the general disorder consisting of febrile excitement, modified and overborne by depression of the vital powers. The pulse is frequent and hard ; at first with indication of strength, but soon betokening manifest debility. The tongue is usually tremulous, and covered with a thick, dark-coloured, offensive fur ; moisture gradually leaves it, and it ultimately becomes shrunken, hard, brown, and dry. The urine is scanty, high-coloured, and of unpleasant odour ; sometimes apparently suppressed. Sometimes there is diarrhoea, sometimes constipation. Rigors are frequent ; followed by perspiration, usually profuse. There is much restlessness, with agitation of manner, anxiety of expression, and pinching of the features. Respiration is hurried and sighing, and there is a sensation of oppression at the chest.

* It is difficult to resist the temptation to quote here a beautiful description of some of the more striking features of this disease, from the non-professional pen of a most close and skilful observer of nature—in all her varied phases and forms :—“ But there were times, and often too—when the sunken eye was too bright, the hollow cheek too flushed, the breath too thick and heavy in its course, the frame too feeble and exhausted, to escape their regard and notice. There is a dread disease which so prepares its victim, as it were, for death ; which so refines it of its grosser aspect, and throws around familiar looks, unearthly indications of the coming change—a dread disease, in which the struggle between soul and body is so gradual, quiet, and solemn, and the result so sure, that day by day, and grain by grain, the mortal part wastes and withers away, so that the spirit grows light, and sanguine with its lightening load ; and feeling immortality at hand, deems it but a new term of mortal life—a disease in which death and life are so strangely blended, that death takes the glow and hue of life, and life the gaunt and grisly form of death.”

The mind is either greatly depressed, or excited by occasional delirium. The strength is much prostrated ; hiccup sets in ; and then fatal collapse is imminent.

IV.—*Ulceration and Sloughing.*

Until lately, the Hunterian theory was generally received, that ulceration, or the process whereby a breach of continuity is effected in a living solid, by the action of the part itself, was the exclusive work of the absorbents.

Ulceration, however, may be more properly regarded as a *molecular death* ; a gradual softening and disintegration of tissue ; the dead fragmentary detritus being separated and carried out of the system, mixed with the purulent, fibrinous, and serous products derived from the proliferation of the connective tissue of the parts around, which are similarly, but less destructively, affected by the same inflammatory process.

1. We observe in every sore where ulceration is progressing, the minor stages of the inflammatory process ranged around in concentric series, with suppuration and softening occupying the central part ; 2. Disintegration—or death and detachment in minute portions—commencing centrally ; 3. Mixture with the pus formed in and around the dead and dying particles, and removal in one common discharge. With this process, while in progress, absorption can have nothing to do.

Ulceration may occur either in an unbroken part, or where there has been previously a breach of structure. The process is begun by inflammatory change, which sooner or later reaches the suppurative result. It does not stop there, but advances a step further. To the rapid proliferation of the connective tissue-cells, with suppurative breaking up, is added molecular disintegration of the parts within which the pus corpuscles have formed. In fact, ulceration is only an aggravation and intensification of the rapid cell-formation with textural disruption and shedding of the corpuscles (pus) which in some degree accompanies acute suppuration.

On an open surface, the *debris* mingles with the purulent discharge, and so escapes. On a surface previously unbroken, the discharge accumulates in the form of a pustule or abscess ; this breaks, its contents are evacuated, and the broken up surface is then disclosed beneath. The suppurated space of an acute and recent abscess extends by rapid proliferation of the connective tissue corpuscles ; when opened, its walls constitute an ulcerated surface.

So long as the high grade of the inflammatory process continues, ulceration does not cease ; the greater the grade and extent of the former, and the less the amount of vital power in the part and system, the more certainly will the result of the inflammatory process be destructive, and therefore the more rapid and extensive will be the progress of ulceration—ranging from the *simple* or *acute* to the *phagedænic* or to the *sloughing*.

On the other hand, ulceration of some portion of the part undergoing the inflammatory process having once occurred, the morbid irritation may cease ; and then the destructive result is followed by reparation. Now the connective tissue proliferates more slowly. While the superficial corpuscles, cut off from their nutriment, undergo fatty degeneration, and are shed as pus, those lying deeper, presenting the faintly granular appear-

ance of the so-called exudation corpuscles, and lying closely grouped together, with a little intercellular substance interspersed, constitute the granulations which cover the surface of a healthy healing sore (Figs. 12 and 13). In other cases inflammatory change may remain, in a subdued form ; and then ulceration advances stealthily and slowly, and is said to be of the *Chronic* type.

The more active the ulcerative process and its accompanying disintegration, the less laudable is the purulent discharge ; thin, acrid, not unfrequently bloody—sometimes pultaceous, because more or less impregnated with the softened *debris* of texture. When, on the contrary, in cases where a failure of the powers of life occurs, the affection not only subsides from the inflammatory standard, but becomes insufficient even for the work of repair, the discharge is almost entirely serous, containing few or no corpuscular elements.

Certain tissues are more prone to ulceration than others. Skin, mucous membrane, and areolar tissue, are peculiarly liable to fall before it ; while the vascular, nervous, and fibrous tissues resist it stoutly. Often advantage is derived from this ; sometimes evil. The comparative immunity of the nervous and vascular tissues is plainly beneficial. And, in like manner, it is often fortunate that important parts are protected by compact fibrous expansions, which are slow in being involved in and broken up by the cell proliferation of advancing suppuration. But when the purulent collection is bound down by a fibrous layer, then mischief is likely to accrue ; inasmuch as the firm fibrous tissue remains unsoftened, and resists the natural tendency of the pus outwards—by the proliferating disruption of the ultimate corpuscles of intervening texture—and deep and important parts suffer the more by the continuance in them of the irritation with destructive results.

The *Causes* of ulceration are the same as those of the inflammatory process. Whatever favours the occurrence and continuance of the highest (or destructive) grades of this, and whatever is unfavourable to due maintenance of vital power in the part, whereby the morbid changes in the nutrition of the connective tissue cells might be resisted or controlled, is a cause of ulceration.

Ulceration is often attended by marked constitutional symptoms. If acute, there is febrile disturbance of the inflammatory type. If chronic and tedious, with a profusion of discharge, hectic may ensue. If phagedænic, irritative fever exists ; often of a grave character. The sloughing sore is not unfrequently accompanied by typhoid symptoms.

Loss of substance may be caused otherwise than by ulceration. It may be the result of mere absorption, interstitial or continuous ; it is then a gradual process, not necessarily dependent on inflammatory change, and unaccompanied by suppuration. In such cases cell-proliferation is either diminished below the natural standard, or where it occurs, fatty degeneration takes place, so that the cell-membrane disappears, and rapid absorption, with complete removal, ensues.

Sloughing.

Death of some portion of the part implicated in the inflammatory

process may be reached at once ; from intensity of effect in the original cause of irritation—extent of texture implicated in the modification of the nutritive, nervous, and vascular functions thereby produced—deficiency of power in part or system—or a combination of all of these conditions. Or the intervening stages of suppuration and ulceration may have been either barely touched at, or more or less dwelt upon. The broken up texture, softened, and infiltrated by serous, fibrinous, and purulent results, as well as by extravasated blood, may have its circulation wholly arrested, as by the pressure of confined inflammatory products ; and it dies ; not by particles, slowly and almost imperceptibly, but plainly, at once, and in mass ; or vital power in the part and its nutrient centres ceases from exhaustion, circulation and nutritive change and exchange are arrested ; and now, in both instances, chemical change advances unopposed, and the part is decomposed by putrescence. When the part so dying is small, it is called a slough, and the process that of sloughing ; when large, as, *e.g.*, when implicating the whole thickness of a limb, the part, when dead, is called a sphacelus, the process sphacelation.

VARIETIES OF THE INFLAMMATORY PROCESS.

Many and various have been the subdivisions connected with this part of the subject. One of the most important is that into *Acute* and *Chronic*. In the one case, the disease advances with more or less rapidity through its various stages ; and, having reached a climax more or less elevated—suppuration, ulceration, or gangrene—declines with a corresponding degree of alacrity. In the other, the time occupied is not as in the former a period of days or hours, but perhaps of weeks or months. The disease begins of a sluggish type, and retains that character throughout ; dwelling long on the minor stages ; seldom reaching to suppuration or ulceration, and still more seldom to gangrene ; hovering rather on the constructive side of the suppurative crisis, and consequently dangerous to normal structure by favouring plastic change and its subsequent organization. When, after having reached its climax—however low—it begins to subside, the decline is proportionally gradual ; and often proves unsatisfactory, because not only tedious but imperfect.

The two forms may be commingled. The disease, though at first acute, receives a check, by treatment or otherwise, and does not wholly recede, but merely dwindles down into a subdued form, and there remains. Or the inflammatory process may be at first, and for long, chronic ; and by the application of renewed stimulus, the acute form may be super-added, or, as it were, ingrafted on the chronic. And this is an occurrence invariably fraught with imminent danger ; for, by the chronic form, structure has been materially changed, as well as vital power impaired ; and the part is so rendered an almost unresisting prey to the acute attack. Such a succession of the forms is very likely to be induced by injudicious or rash treatment ; and ought to be carefully guarded against.

The acute we may consider as representing the ordinary type of the inflammatory process ; already discussed. A few words will suffice

to indicate the peculiarities of symptoms and results connected with the chronic form.

Symptoms of the Chronic form.—The disease being both mild and gradual, the symptoms are comparatively little developed, and hence sometimes obscure. Redness, swelling, pain, heat, are slight; and of the two last, sometimes there is almost nothing. Swelling, however, though at first slight and slowly induced, ultimately becomes a prominent and most important feature. It is considerable in extent—for it has been of long continuance, and steadily, though slowly, increasing; dense and firm in character—consisting chiefly of fibrinous and plastic results from the first, or the serous product, if present, having become absorbed; and lasting—the new formations tending to permanency of stay by organization. There is seldom any notable degree of tension; for, the increased cell-formations having taken place gradually, the parts have duly accommodated themselves to their reception. Suppuration, ulceration, and gangrene, if attained to, are, like the process which preceded them, slow and gradual in their advance to completion; attended by the ordinary symptoms of such results, in a mitigated form.

Rapid and tense swelling, with softening of texture, we saw to be characteristic of the acute form; gradual enlargement, with induration, is characteristic of the chronic. The function of the part, however, is generally not less involved in the chronic than in the acute form, at least when a considerable part of an organ is affected.

The constitutional symptoms are proportionally mild. Febrile disturbance may be so slight, as scarcely to be appreciated by either the patient or his attendant; and, when perceived, it may be both so obscurely marked and so transient, as to baffle or deceive in the effort of tracing it to its cause. The most prominent symptoms are:—want of refreshing sleep; loss of appetite; general emaciation; change of colour, in the general surface, to a pale or dirty yellow; occasional flushes; sensation of cold, and frequent inclinations to shiver; impairment of strength, and a general feeling of uneasiness; the patient feels that he is ill, yet scarcely knows how or where. In the severer forms, the febrile condition is more marked, and partakes more or less of the inflammatory type:—headache, heat, frequent and hard pulse, dry skin, scanty urine, thirst, restlessness. Yet, the local disease remaining chronic, the fever never attains to the form of the truly inflammatory; it is less sthenic, less marked, less progressive, less continued. The tendency to remission, sometimes almost complete, is one of its most distinctive characters; the period of exacerbation is evening, or the early part of the night: morning that of remission, with or without perspiration. Sometimes the local disease itself deceptively assumes somewhat of the remittent character; seeming to have abated, or even ceased, during several days; while all the time it was steadily though stealthily holding its ground—if not advancing.

It should never be forgotten, that however slight and apparently trivial the constitutional symptoms of a chronic inflammatory process may be, yet, by their mere persistence, they are likely to exhaust the frame, and threaten even a fatal termination.

The *Results* of the Chronic Inflammatory process are thus seen to

be chiefly formidable by long continuance of the disease, and by the insidious nature of its progress ; change of structure, all but irreparable, may have occurred, before the attention of either patient or practitioner has been directed to the part. Gradual alteration of structure is the most ordinary result ; by interstitial proliferation of cell elements, which become more or less highly organized and persistent. Suppuration, ulceration, gangrene, though comparatively rare, yet may and do occur. They can scarcely be avoided, if the chronic form of disease, after having for some time existed, suddenly becomes merged in an acute seizure.

Another important division is into the *Sthenic* and *Asthenic*. The former follows the ordinary course of the inflammatory process, and shews no tendency to spread diffusely ; pus, when formed, is surrounded by the barrier plastic product ; and the constitutional disorder is of the Inflammatory type. Such is the inflammatory process which constitutes an ordinary acute abscess.

The *asthenic* variety tends to spread rapidly ; the process of cell-proliferation is not of the plastic type ; suppurative cell-degeneration is soon attained, and the pus is not laudable ; the parenchyma is open to infiltration, and becomes infiltrated ; destruction of texture follows ; and the attendant constitutional symptoms are those of Irritative fever, often of a low and grave kind. Such disease is well exemplified by diffuse cellulitis, and the worst forms of erysipelas. There is good reason to suspect that the blood is in a depraved state—favourable rather to the destructive than to the constructive results of the inflammatory process—previously to the inflammatory attack ; and that this morbid condition of that most important fluid becomes further aggravated by the materials introduced into it during progress of the local disorder. Occasionally, the exciting cause is directly concerned in the unfavourable type ; as in the case of inoculation by poisonous matter, or infiltration of the textures with the urinary secretion.

It hardly needs to be stated that the energetic treatment, often demanded in the sthenic form, is in the asthenic wholly unsuitable.

THE MANAGEMENT OF THE INFLAMMATORY PROCESS.

Prevention.

Therapeutic means, applied immediately after removal of the exciting cause, may have the effect of entirely frustrating its ordinary operation, and preventing inflammatory accession. For this purpose, the period of incubation must be diligently improved. To insure success, it is not only necessary, as can be readily understood, that the suitable means be early and sedulously employed, but also that the cause shall have been slight as well as transient ; that its removal shall have been entire ; and that the part have its vital power as yet unimpaired. The first effect of the stimulus we saw to be an impression both on the textures of the part as well as on the nervous system ; and thus tending, in a twofold way, to a morbid result. The first object of preventive manage-

ment is to mitigate or remove these untoward influences. By some, hot water, or its steam, is applied constantly ; and it is not unlikely to succeed in subduing the nervous excitement—so breaking off one element at least of the first link in the chain. But the second step of the initiatory process, seldom far disjoined from the first, we saw to be a change in the circulation of the part, which is likely to be pushed on by those very applications whereby the other nervous impression is held back. Cold, continuously applied, is therefore preferable ; inasmuch as it is calculated to fulfil a threefold indication, by exerting a soothing or sedative effect on the textural vitality, as well as on the nervous and vascular systems of the part, and so rendering accession of the inflammatory process more improbable. Any means we can employ which will remove these first links of the chain is likely to frustrate its further formation.

But this simple remedy requires nicety and care in its application. The first effect of cold, as formerly stated, is sedative, the second reactive ; the first is opposed to textural and vascular excitement, the second invites its occurrence ; the first we desiderate, the second we wish to avoid. To be prophylactic, therefore, its application must be continuous ; if interrupted, however briefly, reaction is imminent—not only to arrest, but to undo the good effects of all the previous precaution. The part is covered by a loose layer of fine lint, and a trustworthy attendant keeps this constantly moist and of low temperature, by cold water frequently and gently dropped on it out of a sponge ; the slightest dryness or warmth being dreaded, as directly opposed to the object in view. Or the assistant may be dispensed with, and a process of constant irrigation employed ; a thin strip of lint, or a skein of cotton, being arranged as a syphon in communication with the part, and a water-vessel placed in its immediate vicinity ; or by means of a lump of ice suspended in a bag over the injured part, water of a known temperature drops constantly upon the surface. In any case, the bed-clothes should be protected by the interposition of oil-cloth or gutta percha ; arranged slopingly, so as to favour the draining away of the water, after it has trickled over the seat of injury. The part is to be kept absolutely quiet, or at least as much so as circumstances will possibly permit ; and it should also be so placed as to favour venous return and oppose arterial influx ; at the same time relaxing those muscles which are either directly or indirectly implicated. Low diet, too, with abstraction of all stimuli, whether local or general, must be strictly enjoined.

Parts simply stimulated—that is to say, without wound—may by such treatment be altogether saved from inflammatory accession. And many incised wounds may thus be brought to rapid and almost painless healing, by *adhesion* ; the inflammatory process not having been wholly prevented, but being kept subdued and limited in its range to the constructive results.

Treatment.

Removal of the cause, if within reach, ought assuredly, in every instance, to be our first care. That preliminary point having been successfully carried, we will then be enabled to attain our principal object by the use of comparatively slight means ; with little trouble to our-

selves, and at the expense of comparatively little pain, annoyance, delay, or danger to the patient. Whereas, let the all-important preliminary step be either neglected or imperfectly secured, and the most powerful remedial means may be unceasingly employed, with little or no avail. A patient applies for relief, on account of nascent conjunctivitis, caused by the lodgment of foreign matter on the surface of that membrane. Remove the particle of dust or sand at once ; and fomentation, a shade, a purge, careful diet, with perhaps a few leeches, will, in the great majority of cases, suffice to dissipate even the most formidable of such affections, within a few days at the utmost. But, on the other hand, leave the foreign matter imbedded in the inflaming part ; and leeches innumerable ; bleeding from the arm, or from the temporal artery, once and again ; blisters in rapid succession ; purges ; antimonials ; mercury pushed to profuse ptyalism, and perhaps repeated—in short, ruin to the system, by severity of treatment, may be enforced and endured, without arresting the disease, or preventing loss of vision by irreparable change of structure. This is not mere fancy. Cases are on record of eyes having become pearly-white and sightless, notwithstanding the induction of anæmia, dropsy, and mercurial disease, by the attempts to save ; all the while, some small particle of foreign matter lodging undisturbed, and probably unsuspected, under cover of the upper eyelid—the simple removal of which might have preserved both sight and system for the patient, as well as credit and conscience for the practitioner.

Our first duty is to inquire carefully for the exciting cause. If already removed, good and well ; if still in operation, we are to procure its abstraction as speedily and effectually as may be in our power. And then we are in a favourable position to proceed with the directly remedial means—those which, being opposed to advance and persistence of the inflammatory process, are termed *Antiphlogistics*. The most important of these is *Blood-letting* ; and the blood may be taken, either from the part, or from the system at large.

1. *General Blood-letting*.—In the outset it is to be observed, that this is not always—or, indeed, usually—necessary now-a-days. It is a spoliative remedy, of the highest class ; and therefore never to be had recourse to, unless circumstances declare it either imperatively demanded, or at least highly expedient. There is every reason to fear that this little operation is still too frequently employed ;—unnecessarily, when it might have been well superseded by other and more gentle measures ;—unwarrantably, when actually no benefit, but sad injury, has flowed from and with the “purple stream.” It is a very easy matter to take away blood, and thereby induce debility ; while to undo that result is in most cases difficult, and may be impossible. Congestions, serous effusions, bloodless skin and mucous membrane, atrophied and all but palsied muscles, a withered frame and an enfeebled mind, may remain, silent, yet steadfast and truth-declaring witnesses of the error in practice. On the other hand, the practitioner will be equally culpable who refrains from this operation, when the circumstances of the case call plainly and loudly for its performance. And it may be stated broadly, that general blood-letting is likely to be required, when the inflammatory symptoms—local, general, or both—are severe ; when the part affected is of importance in

the animal economy ; and when a delicacy of texture is involved, whose maintenance is essential to important function.

Bleeding is not to be regulated by its absolute amount, but by its effects. No foregone idea should be entertained, that in one form of disease a certain number of ounces will suffice ; while in another, a greater, and in a third, a less amount must be invariably taken. In every case, the thought of mere measure is ignored ; blood is permitted to flow on, until the desired effect has been obtained ; and then the stream is arrested, irrespective of whether the ounces amount to three or thirty. The fewer the better.

In connection with this point, it is further to be remembered, that the inflammatory process engenders a *tolerance* of this remedy. A young, robust, healthy man, may be bled when he does not require it ; but, most probably, not many ounces shall have flowed, ere nature interposes her objection to the procedure, and syncope occurs. Whereas, open a vein in the arm of even a weak, pale-faced, nervous patient, who is the subject of an acute inflammatory seizure in some important part, and it is not improbable but double the amount or more shall have been withdrawn, ere any considerable effect has been made upon the system. So truly and generally does this obtain, that an important auxiliary in diagnosis may be thence derived. You are bleeding a patient ; in doubt whether the disease is truly inflammatory or not ; but you suspect that it is, otherwise it is likely you would not have performed venesection ; only a few ounces have escaped, when the patient grows pale and faint ; you arrest the flow, and reconsider your diagnosis, suspicious of an error. But should no faintness threaten after a full or even large abstraction, doubt is removed ; your diagnosis is confirmed ; you advance unhesitatingly with antiphlogistics ; the disease is there, and has engendered a tolerance of the remedy. On coming to a conclusion from this test, however, care must be taken to ascertain that the syncope, or tendency thereto, is an actual failing of nature ; the effect of the loss of blood ; not the result merely of fear, or other depressing agency, on the patient's mind. When aware that the patient is naturally timid, and liable to faint from this cause ; and when at the same time confident that he labours under inflammatory disease, and that the circumstances demand effective blood-letting—we bleed him in the recumbent posture, and with a gentle stream.

Tolerance of bleeding will also be found to vary according to the sex, age, and temperament of the patient ; greater in the male than in the female ; least in the lymphatic, greatest in the sanguine temperament ; greater in adult age, than at either of the extremes of life ; in early infancy it is most especially small, but quickly recovered when lost ; in advanced years loss of blood is not likely to prove so obviously and directly calamitous, yet it is a spoliation hard to be borne, for the powers of life do not admit of repair so readily as in the young. Tolerance also, be it remembered, is but temporary ; great at the beginning of the inflammatory change, it ceases towards its end.

Similar tolerance of appropriate remedies seems often to be generated by disease. In fact, it may be laid down as almost a general rule, that a remedy—in itself severe—may, when appropriate to a given form of

disease, be administered in even large quantity during the persistence of that disease, with not only relief to the symptoms, but with comparative impunity to the system at large ; whereas the same remedy, given even with a sparing hand, while no such call for its employment exists, is likely to affect the constitution injuriously. In some nervous affections, for example, opium has sometimes to be given in large doses ; a tithe of which would fatally poison the person, if in health. In pneumonia, antimony has been given to an extent which would, under other circumstances, be absolutely intolerable. In iritis, synovitis, and certain forms of the venereal disease, in which the use of mercury is not only expedient but essential, that mineral can be pushed with safety ; while it is to the sakeless salivations—errors either of judgment or of diagnosis—that the ruin of mercurially-shattered frames is attributable.

The Effects of general blood-letting, in so far as they are antiphlogistic, are—1. A sedative result on the heart's action, and on the general circulating system ; effected partly by withdrawal of its wonted stimulus from the central organ ; and partly by the depressing effect of sudden loss of blood on the nervous system, which reacts in a corresponding strain upon the circulation. And this sedative effect on both heart and arteries is proportionally indicated, by diminution of the hardness and thrilling of the pulse, as well as of its fulness and frequency. It is plain how such a lull is advantageous, as regards both the local change and the fever which accompanies it. 2. The blood is diminished in absolute volume. In some cases this is not desirable ; on the contrary, we may be not more anxious to crush the rising inflammatory process, than to husband the vital resources already weakened, and especially to retain this all-important fluid unwasted ; we therefore bleed sparingly if at all. Yet there are cases—as in inflammatory disease occurring during well-marked plethora—in which diminution of the volume of the blood will favour resumed general control of circulation ; at the same time lessening the probability of sanguineous determination to any individual part. Again : in inflammatory affection of the chest, in connection with wound, while one lung is collapsed, and the other is labouring with its increased burden, mere diminution of the blood's bulk is obviously, for mechanical reasons, calculated to afford important relief. 3. The blood is also materially affected as to its component parts. The red corpuscles and albumen are diminished. And after repeated and extreme bleeding, the fibrin will be found of less quantity in the blood which remains in circulation. 4. Derivation of blood is effected from other parts to that whence the blood issues ; the inflamed part probably benefiting in an especial degree. However this is produced—whether according to mechanical or vital laws, or both—microscopical observation, corroborating what had been previously inferred from experience, has established the fact that it does occur. This derivative effect is plainly in favour of relief to the burdened part. It may be that it is but temporary, ceasing as soon as reaction occurs. Yet, granting such to be the case, still an important advantage has been obtained ; inasmuch as even this temporary relief may be such as to modify the nutrition of the textures undergoing the inflammatory process, and thus both to check farther cell-proliferation, by obstructing

nutritive supply, as also by enabling the arteries leading to the part in some degree to recover their tone ; and this is the more likely to occur if, meanwhile, the excitation which causes the inflammatory process has been removed. Besides this, as after blood-letting we find that the amount of fibrin in the blood is more speedily restored than its corpuscles or albumen, there seems good reason to believe that the loss of blood, by causing derivation, promotes absorption of the inflammatory products, thus relieving the tension of the part affected, which would otherwise prove a material element in exciting the progress of the disease, and its termination in destructive results. 5. The action of other remedies is facilitated. "By lessening that morbid impetus of the blood by which during the state of inflammatory fever the natural excretions are apparently impeded, and at the same time by promoting absorption into the blood (as loss of blood is well known to do), it favours the effect of all other evacuating remedies intended to act on the excretions of individual parts of the system." And further, by its precedence, it renders certain remedies—as mercury and opium—decidedly beneficial, which otherwise would have proved either inoperative, or absolutely injurious. It is specially qualified to lead in the attack ; the others to accompany or to follow.

These beneficial results of blood-letting are materially affected by the manner in which the blood is drawn. As already stated, it is desirable, in the great majority of cases, to obtain the resolute effects at a cost of as little blood as possible ; and, with this view, the manner of abstraction becomes all-important. Make a large orifice in a vein or veins, let the blood escape in rapid, full stream, with the patient in the erect or semi-erect posture, and syncope is soon arrived at ; these circumstances tending to sudden withdrawal of wonted stimulus from the heart, and diminution of arterial supply to the brain. Whereas, blood may be taken in large quantity—especially when tolerance by disease exists—from a small aperture, in a slow and small stream, during recumbency ; in fact, the system may be thus almost wholly drained of blood, ere faintness threaten to ensue. And thus we see how slow venous hemorrhages, of accidental origin, prove so dangerous ; faintness—so favourable to the spontaneous and effectual arrest of the flow, by formation of coagulum—being too long deferred. Syncope may be, in truth, regarded as Nature's safeguard against hemorrhage. In the case of accidental wounds, it usually supervenes ere actual danger has accrued from the loss ; allowing the vascular orifices to contract, and to become occluded by coagula. When blood is designedly taken in the treatment of disease, and when it is proper that blood should be so taken, there is tolerance ; or, in other words, syncope remains in abeyance, till a sufficiency shall have passed away. But should an error of judgment have been committed by the practitioner, Nature is ever watchful to retrieve it ; and, where blood is flowing when it ought not, very little is lost ere syncope steps in and arrests the stream.

In antiphlogistic bleeding, then—except in the comparatively few cases in which actual loss of blood is desirable, for its own sake—the abstraction is made rapidly, in the erect or semi-erect posture. But syncope is to be approached, rather than actually attained. Our object is, not only to produce, but to maintain, a sedative effect on the heart and

general circulation. If syncope occur, reaction is almost certain to prove excessive; whereas, if the immediate result be less extreme, it is more easily retained. Besides, a faint may prove in itself somewhat dangerous; if there be either organic disease in the heart, or considerable effusion in the pericardium, cessation of the heart's action may prove permanent. So soon, therefore, as the symptoms of approaching syncope show themselves, we usually desist; when the patient grows pale, and articulates faintly and with difficulty; when he begins to fail from the semi-erect posture, sighs, and shews signs of nausea; when the lips grow dry, white, and quivering, the eyes dull and glassy, and a cold sweat bedews the face and forehead; when the pulse becomes weak and fluttering—then we bind up the arm, and place him gently recumbent. About twenty ounces may be estimated a fair average first bleeding, in the case of acute sthenic disease in a robust adult; but, in general, as already stated, it is better to keep mechanical admeasurement altogether out of the question.

From depression by bleeding, the circulating system rouses itself, more or less rapidly; and the result is termed *Reaction*. This either remains of a tolerably quiet and subdued character, the inflammatory process having simply given way; or it becomes excessive. And excessive reaction may be of two kinds. 1. It may be of an *asthenic* or nervous character; indicated by rapid, soft, and jerking pulse, oppressed breathing, headache, and tinnitus aurium, general nervous excitement, and non-return of the ordinary inflammatory symptoms—a state of system very similar to what follows accidental loss of blood in large quantity. To bleed again, would be to aggravate such disorder. A full opiate is administered; the nervous excitement is allayed; the patient falls asleep, and may awake with a calm pulse and system, relieved as if by the working of a charm. The opium here does not create the sedative impression on the circulation; given by itself, most probably it would not only have failed to quiet, but would have increased the tumult; but, coming after bleeding, it restores the sedative result which this had achieved, but was unable singly to maintain. 2. But reaction may be of an opposite kind—*sthenic*; in fact, a continuance or reaccession of the inflammatory attack. The pulse is hard and vibratory as before; the fever still retains the inflammatory character; local heat and pain are unsubdued. The inflammatory process has been interrupted, but not arrested; remission proves but transient; and the reaccession may be even more fierce than the original onset. This state may have to be met again by the lancet. And a few ounces, drawn then, will often suffice to restore the sedative effect of the former bleeding; while double the original amount may fail to make a satisfactory impression, after time has been allowed for the reaccession to make head and be established.

The paramount importance of *Time*, in connection with blood-letting as an antiphlogistic, should never be forgotten; whether it be practised to crush the rally, or to meet the original attack. Comparatively speaking, one full bleeding of ounces, drawn early—just at the onset—will be far more available, as a remedial agent, than pounds taken at a subsequent period. In consequence of delay, not only will the cure be less complete and satisfactory—change of structure having occurred by cell-proliferation, and restoration proving both gradual and incomplete; but, besides,

to obtain even the incomplete cure then, the system must be sorely shaken by the severity of the treatment employed. "*Obsta principiis*" is the invariable motto of the antiphlogistic phlebotomist.

The signs of bleeding having proved effectual are, in general, sufficiently plain. The pulse loses its hardness and thrilling, becoming soft and compressible; it may be either more or less frequent than before; often the former, at least in the first instance. The local pain and heat cease, or continue in a mitigated form; the other ordinary signs recede; function returns, both in the part and in the system; secretion, general and local, is restored; and, usually, if blood be drawn it ceases to exhibit the inflammatory character. It must be borne in mind, however, that the last result is not invariable. Exceptions to the general rule, in this respect, are by no means unfrequent; and blood may be at least buffed, if not cupped likewise, although the disease has given way; while on the other hand, this may be persisting, while the blood seems scarcely sizy. It therefore follows, in either case, that when the evidence of the blood is opposed to that of the other inflammatory signs, the latter are believed, and guide the practice.

Certain circumstances materially affect the practice of blood-letting, and ought always to be taken into consideration. 1. The duration of the disease. As a preventive measure, blood-letting is a mere waste; it might never have been required; while, by debilitating, it may produce an inflammatory process of an asthenic type. The attack having truly begun, general bleeding may be expected to produce the happiest results; at a more advanced period, a greater quantity of blood must flow, though still the effect may be in the end satisfactory; but after some considerable time has elapsed, when the inflammatory product has accumulated, the system may be drained of blood to an absolutely ruinous extent, and yet little impression may be made upon the local affection. 2. The age, sex, temperament, and occupation of the patient. The three first have been already noticed, as affecting the tolerance of the remedy. Occupation is equally important. The robust and temperate peasant is abler to bear, and may therefore require a larger bleeding, than the pale and too often dissipated inhabitant of the crowded city. And, again, among the latter class important variety is found; some—brewers' servants for example—being especially intolerant of this remedy. 3. The nature of the part affected. Many a smart inflammatory affection of an external part requires no blood-letting; while a comparatively small amount of the inflammatory process, affecting an internal and important part, may demand this remedy, and impart to the system power to bear the necessary spoliation. Blood-letting is of little service in inflammatory affections of mucous membranes, and is most beneficial in the acute inflammatory diseases of serous and parenchymatous parts. 4. The state of the system previous to the inflammatory attack. The patient may have been plethoric. We may then bleed freely. He may have been anæmic. We, in that case, either forego venesection altogether, or practise it most cautiously; using every means in our power to secure the desired effect with the least possible expenditure of the valuable fluid. 5. The ulterior result. After severe mechanical injury, it is very desirable to limit the coming sloughs and suppurations; and an obvious

means of doing so, is by active antiphlogistic measures to mitigate the inflammatory process which is setting in. But, in effecting this object, blood must be taken sparingly, if at all, and with much caution; seeing that a certain amount of sloughing and suppuration is inevitable, necessarily accompanied with depression and exhaustion of the vital power, which we should desire to save for the reparative process which we expect to follow. That must be provided for. It may be very easy, by heroic expenditure of blood, to attain the object immediately in view; but it may be very difficult to prevent the rash blow which would limit the impending inflammatory attack from at the same time annihilating the patient's chance of ultimate recovery.

General blood-letting may be effected from an artery—*Arteriotomy*; or from a vein, *Venesection*, or *Phlebotomy*. When Arteriotomy is performed, a superficial anterior branch of the temporal artery is generally selected. Blood can be thus taken, both in large quantity and with much rapidity, so as to secure the desired sedative effect; but it is an operation which demands more dexterity in performance than venesection, and is besides not unlikely to be followed by troublesome consequences, as will afterwards be explained. A subcutaneous vein, on the contrary, is superficial and easily reached. Blood can be drawn both rapidly and in quantity, if need be, by means of a large orifice; arrest of the flow is more easily effected than in wound of an artery; and the incision is more likely to unite, simply, by adhesion. Hence, venesection is usually preferred. And the points of selection are:—one of the veins at the bend of the arm, for general purposes; and the external jugular vein, in the lower part of the neck, in certain cases. In many patients, especially females affected with obesity, it is not always an easy matter to reach a vein in the ordinary sites; but when foiled there, it does not inevitably follow that arteriotomy is the only other resource. For, if venesection be rendered preferable by circumstances, a sufficient vein—the cephalic—may always be found by an incision placed in the interspace between the deltoid muscle and the clavicular portion of the pectoralis major.

Within the last thirty years a complete revolution may be said to have taken place in regard to antiphlogistic blood-letting. Then it was of frequent occurrence, even on slight cause; now it is rare, under any circumstances. And towards this result, two things have greatly tended. 1. Inflammatory disease has become more asthenic in its character; bearing active treatment badly, and better cured by gentler means. 2. The science of therapeutics, as well as that of pathology, has made advances; and in consequence the morbid change, or succession of changes, is more accurately recognised, while medicinal appliances—by mercury, aconite, antimony, etc., are more skilfully and successfully administered. We know the diseased condition more accurately than we did; and are better skilled to cure it, without any sacrifice of blood.

Hæmostasis, or temporary arrest of a portion of the blood apart from the general circulation, has been proposed as an occasional, or perhaps even frequent substitute for blood-letting; or, at all events, as a useful auxiliary.* The blood of a limb, or limbs, may be readily retained therein for some time, by deligation sufficient to arrest the venous return.

* Maryland Medical and Surgical Journal, March 1843.

And this may possibly have the effect of relieving the general circulation ; the sluices being afterwards slowly opened, so as to permit a gradual return of the pent-up fluid.

On a small scale this plan is of common and successful use. By dry cupping, for example, a considerable quantity of blood may be detached, and imprisoned within the glasses, away from the inflaming part ; as over the loins, in affection of the kidney ; over the shoulder, in affection of the joint ; between the shoulders, in affection of the head or chest. This may be effected on a larger scale in the inflammatory affections of internal organs by exhausting with an air-pump an air-tight tin case applied to the leg or arm, with which it is rendered continuous by means of caoutchouc webbing.

2. *Local Bleeding*.—This operates beneficially on both part and system ; on the former by removing, or at all events diminishing, its sanguineous engorgement ; on the system, by producing more or less of a sedative effect on the general circulation ; indeed it is very easy so to conduct a local abstraction of blood, as to make it equal in this respect to an ordinary venesection. And, further, it is to be borne in mind, how constitutionally important is the early use of such a remedial agent directly affecting the part ; inasmuch as that part being the laboratory whence issues the inflammatory change of the blood, the sooner the inflammatory process is arrested in it, the less will be the probable amount of febrile disturbance in the system.

Local is preferable to general blood-letting under the following circumstances :—1. When the inflammatory process is situated in a comparatively unimportant part. There is no reason why the system should suffer, when local remedies are perfectly adequate to subjugation of the local disease. 2. When the powers of the system have been low, previous to the inflammatory accession. General bleeding being obviously from this cause inexpedient, and the local change having not advanced so far as to create even a temporary tolerance of it, we content ourselves with local depletion. 3. When the inflammatory process has been fully established, and is far advanced by continuance, even great loss of blood from the arm will probably fail to produce a remedial effect on the part. To practise it, would be to weaken the frame unnecessarily. Local bleeding, even repeated, will occasion less general exhaustion under such circumstances, while it is dealing successfully with the disease. 4. Either extreme of age forbids general bleeding ; unless in extreme circumstances. Indeed, in both the very young and very old, local bleeding, when at all considerable, is always in its effects tantamount, or nearly so, to general blood-letting ; and the latter will, in the majority of cases, prove not only unnecessary to the treatment, but absolutely intolerable to the system. Hence, in such patients, while general blood-letting is wholly proscribed, even local bleeding must be practised with caution and reserve.

A general rule applicable to local bleeding has been much insisted on by M. Lisfranc, and not without good show of reason ; namely, that blood, when drawn with an antiphlogistic object, should not be taken immediately from the affected part, unless in large quantity. A few leeches, placed in the near vicinity of an inflaming part, relieve by draw-

ing blood from it. They are antiphlogistic by derivation. The same number, placed on the part, draw blood from the parts around to the source of the flow; and thereby may increase sanguineous determination, instead of relieving it. If direct application is to be employed, the quantity taken must be large; truly spoliative; as it were, emptying the part, notwithstanding its borrowed supply from the vicinity. Local bleeding, therefore, to be antiphlogistic, must either be small in amount and indirect in its extraction, or direct and copious. Let it be the latter, when a constitutional as well as local effect is both expedient and permissible; the former, invariably, when we are anxious to husband the general vital powers, and to attack only the local malady. The foregoing observations, of course, do not apply to abstraction of blood directly from the part by puncture, scarification, or incision; these, however slight or few, cannot fail to rifle the part of its fluid contents—more or less; and, besides, they have other indications fully as important to fulfil.

Blood is withdrawn locally in various ways; by cupping, leeching, puncture, scarification, incision.

Cupping.—This, when the means are at hand, and the nature of the part is suitable to their application, is perhaps the preferable mode; less tedious and annoying than leeching, and likely to prove also more effectual. Rapidity of abstraction we saw to be useful, in obtaining a sedative effect on the system. It is similarly useful when directed upon the part. Much blood may require to flow by the slow oozing of leech-bites, ere the spoliative and sedative result is obtained. Half the quantity, suddenly removed by cupping, may prove equally or even more successful.

This little operation is performed in the following manner:—The surface is first hotly sponged; and then the cups, duly exhausted by a spirit-lamp, are fixed on the parts whence the blood is to be taken. This creates a determination to that portion of the surface; at once facilitating abstraction of blood, and causing a derivation—itself favourable to the inflaming texture. By heat and moisture, this determination to the surface is maintained throughout the operation. The cups having been removed, the scarificator is instantly applied to the red and swollen parts. The instrument is pressed lightly on; and the range of the lancettes is so modified, that they shall not penetrate more deeply than the true skin; otherwise the adipose tissue fills the wounds, and arrests the flow of blood. The scarificator, so soon as it has been discharged, is replaced by a hot sponge; and this again by the glass, fully exhausted; yet not too much so, otherwise marginal pressure may be so great as to obstruct the circulation of the part. The changes are made as rapidly as possible. The blood, as it escapes more or less freely, rises to fill the vacuum. So soon as it begins to coagulate—or sooner, if the flow be tardy—the glass is removed and emptied; and is then reapplied, freshly exhausted. On each re-application, it is well to shift the glass slightly from the former site; so that the pressure of its rim may not be injuriously concentrated on one and the same circle of integument. During the intervals of reapplication, a warm sponge covers the wounds; and, on leaving, is made to rub them somewhat roughly, in order to prevent the lodgment of coagula. Detachment of the glass is effected carefully, by pressure of the finger at the uppermost part of the rim; the glass,

thus loosened by entrance of the atmospheric air, is slowly bent, as it were, downwards ; the finger, placed flatly, pressing firmly on its rising edge, so as to sweep all the blood into its interior, leaving the bed and body clothes unsoiled. The number of the glasses, and their applications, are varied according to the amount and rapidity of abstraction desired. The average product of a single glass, skilfully applied, may be held as ranging from four to six ounces.

If the glass be placed over a wound, or wounds, fed by a distinct arterial branch—such as the anterior branch of the temporal artery—the portion of the rim which overlays this vessel, on its cardiac aspect, is to be a little raised ; so as to permit free arterial influx, otherwise the bleeding will prove but scanty.

Abstraction over, the parts are lightly and cleanly sponged, and covered by some simple dressing ; usually they heal readily, by adhesion. But it may be desirable that they should not do so ; the case may be such, as to render the early succession of counter-irritation advisable. The wounds are then treated so as to favour advance of the inflammatory process—irritated by a stimulant, or congested by a poultice—and the scarified part is thus speedily and easily converted into a suppurating issue.

Much ingenuity has been expended in adapting apparatus to the performance of this operation ; but all modifications have, each in their turn, been found inferior to the ordinary mode. Success mainly depends on attention to three points—frequent change of the glasses, using the spirit-lamp with a large wick and a large flame, and a quick horizontal movement (not vertical) of the glass to the part.

Leeches can be used when and where cupping-glasses and scarificators cannot. Their application is best effected by confining them in a glass, or wire-gauze receptacle ; which, inverted, is held steadily till they fasten on the part whence we wish the blood to come. They are thus prevented from sprawling abroad diffusely, as their fancy would probably lead them. The part is previously made smooth by abrasion—if need be—and clean by ablution ; especially if foetid or otherwise noxious matter have been formerly applied. Appetite is increased in the animals by their being made dry ; both outside and in. On this account, they should be kept for some time out of water, and be gently rubbed with a soft towel before application. And it is well also to surround them with cambric, the unsubstantial network of which—affording no firm surface for their tails to rest on—seems to irritate them into activity. If still slow to bite, they may be briefly immersed in warmish porter ; and the part may be smeared, either with sweet cream, or with blood freshly drawn from a puncture. When they have filled and let go, the part is diligently and hotly fomented, so as to encourage oozing from the apertures ; and by this the greater part of the bleeding will probably be taken. Each leech, or rather each leech-bite, may be rated at about an ounce and a half.

Sometimes the hemorrhage is troublesome, by continuance, from one or more of the apertures. Let firm, direct, dry pressure be maintained, for a short time ; and this will probably be sufficient for its arrest. Or, along with pressure, matico may be applied—in leaf, or in powder, or in

strong tincture. If this fail, insert the point of a finely-pencilled portion of nitrate of silver, carefully into (not on) the aperture; press steadily with it there, for a few seconds; and immediately on its removal apply a compress of lint, retained by either the finger or a bandage. It is not often that this procedure is demanded; and still more rarely does it fail, when duly practised. If it should fail, however, then transfix the part by a fine needle, and encompass this firmly by a ligature; as in the formation of the "twisted suture."*

Troublesome bleeding is most likely to occur in children; more especially if the leeches have been applied to parts not only of active circulation, but also exposed to constant or frequent motion; as in the neck. And it is a safe general rule, applicable to leeching at a tender age—when, as we have seen, much bleeding is but ill borne—that the patient be not left, particularly over night, until bleeding has fairly ceased. To leech a child on the chest or neck, to cover the part with a large hot poultice, and to leave it thus for some hours, is to incur the risk of the patient's perishing by hemorrhage.

In regard to children, it should further be remembered, that the loss of blood by a few leeches is equivalent to a full bleeding from the arm in the adult.

But there are other precautions in regard to the application of leeches:—1. They should not be placed where there is either frequent or constant motion; as on the neck, or over the costal cartilages; otherwise, the bleeding is not unlikely to prove troublesome. 2. Nor should they be placed on parts habitually exposed, especially in females; as on the neck or face; otherwise the cicatrices may prove unseemly. And when it is remembered that local bleeding, unless in large quantity, is usually most effectual when indirectly taken from the part, we shall seldom find it difficult to fulfil the foregoing indications. 3. In children, it is well to avoid large superficial veins; especially in the neck. 4. Nor should leeches be placed where the areolar tissue is peculiarly lax and delicate, as in the eyelids; otherwise ecchymosis, acute œdema, or both, are apt to ensue. 5. Nor where subcutaneous nerves or lymphatics abound; otherwise much pain may be occasioned, and the occurrence of either erysipelas or angeioleucitis rendered not unlikely; in the case of the fore-arm, for example, the dorsal will be preferred to the palmar aspect. 6. They should not be placed directly on the part inflaming; for, (1.) unless in sufficient numbers to prove spoliative, their effect may not be antiphlogistic, but the contrary; (2.) because they are apt to prove irritant, and may, by adding fresh stimulus, hurry on instead of arresting the inflammatory process. In addition to the irregular form of wound, and the strain of suction, the introduction of acrid matter from the creature's own secretions may sometimes irritate. On this account leeches are properly superseded by punctures in erysipelas. 7. They should not be placed in the immediate vicinity of an acute ulcer, more especially if this be of a specific kind; otherwise the bites are apt to be inoculated, and consequently to degenerate into ulcers; so extending, instead of

* I think it unnecessary to notice the many other contrivances for stopping leech-bites; being satisfied that one or other of the simple means, here specified, will be found in every case successful.

limiting the evil. 8. Nor should they be applied, unless considered truly indispensable, where bandaging or other retentive means are of paramount importance ; as in fractures of the limbs. For, under such circumstances, the wounds are apt to inflame and ulcerate ; compelling a discontinuance of the most important part of the apparatus, and perhaps at a critical time of the cure.

Blood may also be taken from a part by *Punctures* ; as in simple erysipelas. By *Scarification* ; as in inflammatory affections of mucous membrane—the eyelids for example. By *Incision* ; as in phlegmonous erysipelas. But, in addition to abstraction of blood, these wounds perform the more important office of withdrawing the inflammatory serous and fibrinous product ; thereby affording most valuable relief to the part ; not only removing what has already collected, but also affording a ready exit to what is forming ; and so saving the surrounding textures from destructive infiltration.

Purgatives are generally an important item of the antiphlogistic catalogue ; and are used early. They disburden ; by clearing away accumulated matter from the intestinal canal ; so overcoming one of the most prominent symptoms of the inflammatory disease—constipation. And likewise, by such clearance, they favour the action of other medicines. They deplete ; by causing an increase of mucous exhalation from the lining membrane of the bowels. They may exert a derivant effect in favour of the inflaming part, by bringing an unusual amount of blood to the intestinal canal. They are further of use by opposing assimilation, and thereby cutting off from the circulation its nutritious supply ; thus tending to maintain the wished-for depression of system. During decline of the inflammatory process, they may be still of use—if not contraindicated by general debility—by favouring absorption in general, and consequently hastening the disappearance of redundant product.

They are especially of service in affections of the head ; having a marked derivant effect on the brain, as well as on the upper parts of the body in general. The pallor of the countenance which follows purgation is familiar to all ; as also the lightness and giddiness of the head which are apt to ensue. On the other hand, there are cases in which purgatives cannot but prove injurious ; as in compound and comminuted fractures, where total absence of motion is by far the most important part of the treatment ; in inflammatory affections of the bowels, abdominal cavity, or bladder—when, by determining blood to the affected part or its neighbourhood, as well as by directly or indirectly stimulating its function, they are more calculated to cause aggravation than decline of the disease ; and in injuries of the spine, when from the first there is intolerance of all spoliative remedies.

Purgatives are given, at first, usually of a drastic and searching nature ; afterwards simple, saline, and alterative ; their object being, first to evacuate thoroughly, as well as to promote copious secretion, especially from the liver ; afterwards merely to keep up moderate exhalation from the mucous membrane. If need be, they may be assisted by enemata. Or these may sometimes occupy their place ; when the stomach proves especially resentful of intrusion.

In some cases *Emetics* are useful, at the outset ; producing temporary

collapse with depression, clearing the stomach, encouraging secretion from the liver, interrupting assimilation, and favouring perspiration ; also as auxiliaries to expectoration, they may prove highly advantageous—as in croup. Remedies of this class are of course inexpedient, when there already exists marked determination of blood to the head ; the effort of vomiting would then be dangerous. On the other hand, they may be expected to prove especially beneficial in those inflammatory affections which are preceded and accompanied by obvious biliary and stomachic derangement. In many cases of erysipelas, for example, there is no better commencement of the treatment than full and free emesis.

Mercury.—The mercurial is often the preferable form of purge at the outset of treatment—calomel or blue pill, followed by jalap, scammony, or colocynth, for example ; causing copious exhalation from the intestinal mucous membrane, promoting a free flow of bile, and tending to lower the febrile increase of temperature. But it is not as a purgative that mercury is truly antiphlogistic. We do not desire that it shall pass quickly through, but rather that it should tarry in the *primæ viæ*, so that it may be absorbed thence into the system, and lay hold of this, exerting on it a specific effect ; the systemic seizure, when complete, being usually indicated by foetor of the breath, tenderness of the gums, and rawness of the mouth, which, if the introduction of the mineral be continued, advances to complete salivation. But as it was not the purgation, so is it not the mere salivation which we usually desire. Mercury, gradually introduced into the system, seems to exert a special effect on the texture of the part, in regard to the inflammatory cell-proliferation ; perhaps limiting, or sometimes even preventing, this ; most certainly favouring its disappearance by absorption. This is what we want ; and affection of the gums is not of itself valuable, but only as shewing that impregnation of the system by the mineral is so far advanced as to be equal to the effecting of its truly antiphlogistic results.

From its effect on texture, as an “alterative,” it is very plain how valuable must be the administration of mercury in all inflammatory affections of important internal organs, whose functions must suffer by any considerable change of structure, however temporary ; and also when texture is extremely delicate—even slight organic change producing much disorder, and hard to be recovered from—as in the choroid. When such parts are inflaming, we give mercury with eagerness ; desirous that its constitutional effect should be both speedy and complete. But he is a sadly thoughtless and reprehensible practitioner, who throws in mercury with a loose and careless hand for inflammatory affections in general—real or supposed ; regardless of the risk thereby encountered of hopeless ruin to the system, at no very distant date.

The common form of exhibition is calomel ; usually combined with opium, in the form of pill ; one, two, or at most three grains of the former, with a quarter or half a grain of the latter ; repeated every hour, or every second, third, fourth, fifth, sixth, or tenth hour, according to the haste with which we desire to affect the system. The opium prevents the mercury from acting as a purge, and insures its absorption ; while itself has a beneficially sedative result. In accordance with a laudable desire to obtain the constitutional effect at the least possible

cost of mercury, it has been proposed to give calomel in very minute doses, often repeated ; as the twelfth of a grain every hour ; absorption being supposed to take place very readily and fully from minute doses—as is exemplified in the internal use of arsenic. Such caution is much to be commended ; and such doses are quite allowable, in cases of no great urgency, either as regards intensity of disease or importance of texture involved ; but the old-established and well-tried dose, as above stated, is more trustworthy in the true inflammatory emergency. Should calomel and opium be found to disagree, a convenient substitute may be found in the blue pill, Plummer's pill, or hydrargyrum cum cretâ with opium or Dover's powder. When it is desirable to affect the system with extreme rapidity, or when the ordinary mode of exhibition is peculiarly tardy, or resented by the stomach and bowels, the desired result may be accelerated by rubbing in or applying on lint a mercurial ointment or liniment on the abdomen, the inside of the thighs, in the axillæ, or over the part affected. The mercurial vapour bath for local or general application will be found very serviceable where warmth and moisture to create cutaneous determination are thought desirable.

We cease to give mercury when the gums have been "touched," as the ordinary phrase is ; shewing the attainment to systemic seizure. We recognise that this result is about to be reached, from the foetor of the breath and the tumescence of the gums, behind the upper incisor teeth and molars, both upper and lower. Or we may often stop at a still earlier period ; the symptoms which demanded it having satisfactorily given way. Should the disease, on the contrary, prove obstinate, even after affection of the mouth, the mercury may be cautiously continued, in diminished dose, so as to maintain *ptyalism*, until recedence or change in the symptoms occur ; but, in no case is full, far less sustained, *salivation* at all necessary.

Before enjoining its administration, it is always well to inquire as to the existence or not of idiosyncrasy regarding it ; whether the patient is easily affected, or otherwise ; whether liable to the troublesome eczema mercuriale, or to the dangerous erethismus.

In head cases we may often advantageously carry the use of the mercurial as a purgative into its constitutional effect. In such circumstances, at all events, no opium must be given with it.

Should mercury both gripe and threaten to purge, notwithstanding combination with opium or hyoscyamus, it is well that the doses be given in some bulky aromatic vehicle. In non-inflammatory cases—as certain forms of the venereal disease—such disagreeable tendencies are readily avoided by giving the mercury immediately after the ordinary meals.

Locally, mercury is of use ; in the form of plaster or ointment, applied to the part affected. But the proper time for its employment is later than that of the internal exhibition. It is meet to oppose, not the disease itself, but rather the changes in texture which have resulted. All acuteness of disease must have been previously subdued by earlier and more appropriate remedies ; and then mercurial inunction, by its local stimulant effect, rather than from systemic absorption, may rouse and regulate absorption, so that abnormal product may be removed and the normal condition of texture restored. But, at an earlier period, the same

application, now so beneficial, will surely aggravate the disease and the changes of structure to which it tends.

Opium we have already seen to be of use combined with mercury; as an auxiliary towards the constitutional effect of the latter remedy. Its own direct influence is also favourable. But it must not go in the forefront. Given before loss of blood, or other true antiphlogistics, it further dries up general secretion, seems to increase vascular disorder, and aggravates the inflammatory symptoms, both general and local, especially the former; not unfrequently inducing alarming delirium. Whereas, when occupying a secondary place, by being given at a later period, the sedative effect on the circulation is maintained; the general nervous system is soothed; pain in the inflaming part is assuaged; and with the combination of mercury, ipecacuanha, or antimony, secretion is not opposed. The patient, previously tossed on a sleepless couch, sinks into a profound slumber, and awakes soothed and refreshed; with a soft, moist skin; and with his troubles, both local and general, wondrously abated. After severe bleeding, we have already seen how a full opiate is of much service, in allaying or altogether preventing nervous reaction. But, when much blood has been lost, the dose of opium, although full, and perhaps often repeated, should always be guarded. Soothing is wished, not thorough narcotism. This is particularly true in old people and children.

Let it not be supposed that when opium is given by the rectum, a much larger dose is necessary than when administered by the mouth. The dose should be the same; certainly not greater. Its absorption may be as speedy and complete by the mucous membrane of the lower bowel, as by that of the stomach; perhaps more so; seeing that, as Dupuytren has observed, the function of digestion may interfere obstructively in the one case, but cannot in the other. It is, of course, assumed that the lower bowel is free from fæculent accumulation, and that the fluid opiate is brought into and retained in direct and general contact with the lining membrane within the sphincter.

During inflammatory affections of internal parts, attended with excruciating pain—as in peritonitis—opium must be given in larger doses than usual, and oftener repeated: there is a tolerance of the remedy created by the disease: and, besides, such pain must be subdued at all hazards, otherwise it will inevitably exhaust the powers of life.

In such cases, it may be given alone; its anodyne effect being the paramount indication. But, for ordinary antiphlogistic purposes, it is combined with mercury, antimony, or other auxiliaries, so as to avoid the disadvantageous tendency to arrested secretion which is otherwise apt to occur.

In inflammatory affections of the brain or its envelopes, or when these important parts threaten to become secondarily involved, opium must be either abstained from, or given cautiously in combination; lest it induce determination of blood to the head. If altogether disused, its place may be occupied by conium, which has a directly opposite effect in regard to the cranial contents. If employed, let it be combined with antimony; and let it be given watchfully, with the head well raised and kept cool. Such antimonial combination is extremely useful in all cases of cerebral excitement, which we are very anxious to subdue, and

against which we are afraid to employ opium alone and unmodified in its effects.*

Antimony is a valuable antiphlogistic ; usually given in the form of potassio-tartrate or tartarized antimony. Its effect varies according to the amount of dose. An aqueous solution, containing a sixth, or eighth of a grain, repeated every two hours, will produce diaphoresis ; overcoming the arid state of the skin, and undoing one of the most characteristic symptoms of inflammatory fever.

A quarter of a grain, similarly repeated, not only proves diaphoretic, but also nauseates, and exerts a sedative influence on the general circulation, and that independently of previous loss of blood. Of course, it will prove a more powerfully depressing agent when bloodletting has been premised ; but it is important to bear in mind, that such precedence is not so necessary to its antiphlogistic effect, as in the case of opium. Consequently, in many inflammatory affections, neither themselves very intense nor seated in important parts, antimony, single-handed, may effect the desired depression ; leaving the veins unbereft of their all-important contents.

In the dose of from half a grain to a grain, repeated every two hours, a still more truly antiphlogistic influence, resembling the mercurial, seems to be exerted ; modifying the constitution of the blood, limiting local organic change, favouring absorption, and so tending to restore normal texture and function. And this effect seems to be most distinctly shewn in inflammatory affections of internal organs. Thus employed, antimony is not a mere duplicate of mercury. The debilitating effects of calomel—when sakelessly given—are insidious, protracted, and bode evil for the future ; those of antimony, though producing far more depression and debility, are only temporary. Mercury having done its stipulated work, tends to leave enfeebling effects for some weeks to come ; antimony, on the contrary, where almost poisonous effects have been produced, takes its leave at once, and is heard of no more. When, therefore, a case occurs in which either medicine may seem to be equally able to relieve the part effectually, antimony is decidedly preferable. Again, both may be advisable remedies in the same disease ; each employed at its own appropriate period of the case. Thus, in meningitis following injuries of the head, full doses of antimony are most likely to relieve in the early stage, while the morbid excitement is recent and in progress ; and at a more advanced period, when inflammatory results are to be dealt with, greater reliance may be placed in the effect of mercury. For, as formerly stated, this seems not only to favour absorption of recent and fluid product, but also to be capable of undoing that which is of older date, and some way advanced in organization ; softening it, and so fitting it to be taken away by absorption.

In this country, the doses of antimony seldom range higher than those already specified ; but, on the Continent, when given as a *contra-*

* Dr. Graves' well-known formula is as follows :—

R. Tart. antimonii	Gr. iv.
Tinct. opii	ʒi.
Mixt. camphorae,	ʒviij ℥
Sig.—A table spoonful every two hours.	

stimulant, ten grains and more at each dose, repeated when required, is not unfrequently indulged in. It remains to be shewn, however, whether such heroic measures are in any respects superior to the ordinary mode and amount of administration.

Aconite is a powerful antiphlogistic. It tends to relieve by cutaneous and other secretions. But its most important effect is to lower the heart's action and general circulation. In this respect, indeed, it is perhaps the most simple and yet the most powerful of sedatives. Large doses are anodyne, and antineuralgic; but they are unsafe, and require great watchfulness; and, antiphlogistically, they are unnecessary. Small doses—such as half a drop, or a quarter of a drop, of the strong tincture, in aqueous solution, repeated every hour, every half hour, or every two hours—are quite safe, and are truly antiphlogistic. Often, under their use, the pulse will be found to come down even rapidly; the other febrile symptoms at the same time giving way.

Aconite, probably, has not the same powerful influence on the constitution of the blood and part affected, as antimony or mercury; but it may well take the place of either, in dealing with inflammatory fever, when structural change has not advanced, and when—as in common external affections—the texture involved is not important.

Lately, the *Veratrum viride*, in doses of four drops of the tincture, has obtained much repute as an arterial sedative.

Belladonna, too, is anodyne and antiphlogistic; and, as such, may be given in small doses. As an opponent of erysipelas, it enjoys a considerable reputation.

Colchicum, also inducing a sedative effect on the circulation, and tending to cause increased exhalation from the mucous membrane of the bowels, as well as very marked increase of secretion from both the liver and the kidneys, is plainly qualified to prove highly available as an antiphlogistic. In full doses, continued, it is supposed to exert a specific effect on the part; freeing it from impending change of structure, as do mercury and antimony. Being further endowed with the property of eliminating urea from the system, by its agency on the kidneys, it is especially appropriate to inflammatory affections of a rheumatic origin and character. The wine of the seeds, cautiously commenced, and steadily increased, is the favourite form of the remedy. Its administration must be stopped as soon as it occasions severe griping, with diarrhoea or dysenteric symptoms.

Diuretics in general, by their evacuant effect, may be classed among the not unimportant antiphlogistics; especially their simplest forms; nitrate of potass, bitartrate of potass, sweet spirits of nitre, acid and alkaline drinks, etc. They of course are unsuitable, when the secreting organ, the kidney, happens to be the seat of the inflammatory disorder; for, by their use under such circumstances, the paramount indication of obtaining rest, actual or comparative, for the affected part, would be plainly contravened.

Saline Medicines—the carbonates of potass and soda, nitrate of potass, sulphate of soda, tartrate of potass and soda, bitartrate of potass, etc.—are useful as cooling draughts, promoters of perspiration, diuretics, and adjuvants to secretion from the intestinal mucous membrane; and,

besides, they are supposed, not without reason, to exert a special action on the blood. In consequence of the solvent power which they possess over fibrin, they may affect salutarily the abnormal amount of that constituent in inflammatory blood; "and they may prevent or destroy the aggregation of the corpuscles, and consequently their tendency to separate from the fibrin, and to accumulate in the minute vessels." *

In this way, for example, the good effects of large and continued doses of nitre in acute rheumatism may be accounted for; the excess of fibrin, with tendency to formation of the buffy coat in blood extracted, being peculiarly manifested in that affection.

Antiphlogistic Regimen is not the least essential part of the treatment. It comprehends, 1.—*Diet*. This is to be given but sparingly, and invariably of a non-nutritious character, so long as the brunt of the attack remains unbroken; and, even then, return to more generous food must be gradual and cautious. In general, loss of appetite and loathing of food are tolerably prominent during the inflammatory progress; it is during the period of decline that precaution is necessary, in denying the returning appetite, or deceiving it by unproductive materials. A hearty meal, untimely indulged in, has often reinduced all the mischief. Drink should be bland, simple, and cooling; given often and in small quantities, rather than in copious draughts. Ice, iced water, soda, potash, lime, or lithia water, lemonade or ginger-beer, may be permitted as preferred. Acidulous drinks are to some the most refreshing; and of these it is well to have some variety, as the most palatable is apt to become distasteful after a time. Dilute solutions of nitrate of potass, and of the alkalis combined with vegetable acids, are not only grateful, especially if effervescent, to the parched mouth, but likewise relieve the fevered system by favouring secretion—therefore not unjustly termed Refrigerants. And, besides, we have just seen that they may play an important part as correctives of the blood. 2.—*Rest* of the body, with *quietude* of mind, is plainly an important indication, and ought to be fulfilled so far as circumstances will allow. Restlessness and jactitation are symptoms of the constitutional disorder, as also tendency to apprehension, anxiety, and general disquietude of mind; and consequently are to a certain extent inevitable. The general antiphlogistic management, by removing their cause, is the most effectual means of removing them; but some time is necessary for this; and, in the meantime, much may be done by many little attentions on the part of the attendants.—3. *Air*. When it is remembered how essential is a free supply of good air to the maintenance of a healthy state of the blood, and how imperfect aëration leads to obstruction of the capillaries, systemic as well as pulmonary, the necessity, during the progress of the inflammatory disorder, for due ventilation of the sick-chamber, as also of the bedclothes, bedding, and utensils for receiving excreta, becomes very apparent.

Local Treatment.

Rest.—To procure as complete rest of the inflaming part as circumstances will possibly permit, should be the first care of the surgeon; and

* Hewson's Works, edited by Gulliver, Lond., 1846 (Sydenham Society), p. 41.

to maintain it undisturbed, his efforts should be directed throughout the whole period of treatment. Thus he avails himself of an important advantage which he has over the physician. In surgical inflammatory affections, of external parts, this valuable indication may be often completely fulfilled ; while it can be effected but partially, if at all, in the case of an internal organ—as the heart, lungs, or kidney. Place an inflaming joint in a state of rest, so soon as you are called ; maintain its immunity from motion undisturbed, by splints or otherwise ; and you will not require to take largely from the remainder of the antiphlogistic catalogue. Whereas, permit its play, voluntary and involuntary, to remain uncontrolled ; and leeches, cuppings, blisters, time, may be all freely expended, without securing an equally satisfactory result.

Position.—Not only should the part be put and kept at rest ; it should also be placed and maintained in such a position as to favour the antiphlogistic result. The knee, for instance, is bent ; so as to relax the muscles implicated ; thereby relieving tension, and diminishing the risk of involuntary spasmodic movement. At the same time, the limb is elevated ; in order to favour venous return, and retard the arterial influx.

Cold.—With some it is still an unsettled point, whether heat or cold be the preferable application to an inflaming part ; the question being usually left open, to be determined either by chance or by the feelings of the patient. Heat and cold are both valuable ; but each has its appropriate period for use ; and either, employed out of its own proper time and place, will generally do harm. Cold acts by producing contraction of the arterial trunks supplying the irritated part, as also by diminishing the vital changes in the cell elements of the part, so constituting the determining essentials of the inflammatory process. The virtue of cold is therefore chiefly as a prophylactic ; diligently and carefully employed during the period of incubation. Thus, after the infliction of an incised wound, we are anxious to prevent inflammatory access, or at least to retard and limit its invasion ; and, with this view, we have recourse to the continued application of cold, in the manner formerly described. Should we succeed in averting the inflammatory process altogether, we gradually cease from the application. Should the inflammatory process fairly set in, notwithstanding our efforts to the contrary, it is equally our duty to desist ; the time appropriate for cold has passed, and if its use be persevered in harm will follow. It then acts as an irritant, and by promoting contraction of the parenchyma, favours tension and consequent aggravation. And, during further progress of the disease, it must, by its directly sedative influence, depress vital power in the part ; so favouring the destructive results—suppuration, ulceration, and gangrene. During the inflammatory progress, indeed, it may induce, or seem to induce, abatement of one symptom—the heat ; it may also, by its sedative action, assuage the perverted function of the nerves ; but, in all other respects, the part can scarcely fail to sustain injury by it.

While diligent in its use, therefore, during incubation, we usually desist from it when the inflammatory process fairly begins to get the ascendancy ; the cessation not abrupt, however, but gradual ; from cold to cool, from cool to tepid, from tepid to warm, from warm to hot ; other-

wise, the second or reactive effect of cold is inevitably produced. Prophylactically, it is its first or sedative effect which we desire to maintain. And when departing from this, its fitting time having elapsed, we should beware of inducing the second effect, which, instead of opposing, favours the inflammatory onset.

When disease has fully subsided, and excess of product has greatly disappeared—the part still, however, remaining weak, lax, and swoln, with its blood-vessels in a congested condition—cold again may become serviceable. But it is not applied with intensity; otherwise, vital power might be still further reduced. And it is accompanied by mechanical influence; in the form of *douche*; producing a general astringent effect on the part, stimulating absorption somewhat, and imparting tone to both blood-vessels and parenchyma.

Cold thus is found to be of use at both extremes of the inflammatory process; just before its accession, and subsequently to thorough recession. But during its crescent course, it is usually unsuitable.

To such general rules, however, we are free to admit that there are exceptions. When, for example, a texture of great delicacy is undergoing a minor and recent amount of the inflammatory process, and is threatened thereby with change of structure imperilling its function, we may feel called on to maintain the continuous application of cold, with a view to checking cell-proliferation at all hazards.

Heat and Moisture, plainly less suitable than continuous cold during incubation, are ordinarily preferable during inflammatory progress. They are grateful to the feelings of the patient; and by soothing nervous irritability, allay the sensations of pain, heat, and tightness to some extent. They favour dilatation of the arteries, hasten on cell-proliferation, while at the same time they relax, and promote yielding of the parenchyma, to receive the inflammatory products accommodately. The vessels are relieved by the more extended congestion; and yet texture is not incommoded; there is no tension, and consequently no increase of throbbing and pain, with aggravation of the disorder.

It is very obvious how thus heat and moisture tend to a favourable result during the crescent process; but it is equally clear that, at a subsequent period, their use cannot be continued without disadvantage. For, the acute change over, and its results remaining, that which tends to maintain proliferation, as well as the dilated condition of the vessels, and relaxation of the surrounding parts, is opposed to resolution and positively injurious. There is little doubt that protracted inflammatory disease, with tedious and troublesome suppuration, is often attributable solely to injudicious continuance of poultices and fomentation.

The form of application may be either that of Epithem or Fomentation. The latter is more generally available. A piece of flannel, or sponge, wrung out of hot water, is applied as warm as can be conveniently borne, and replaced by a substitute so soon as the heat begins sensibly to abate. This is continued for half an hour, or more; and is repeated at longer or shorter intervals, as circumstances may seem to demand.

It is well, sometimes, to medicate the fomentation. Chamomile flowers, with heads of poppy, for instance, may be put into a flannel bag;

and this may be used instead of the common flannel or sponge. The patient may be inclined to place more faith in such an application, than in mere hot water ; and, besides, positive benefit is also derivable from the anodyne qualities of the medication.

When the inflammatory process is superficial, and attended with much pain and increase of sensibility, warmth and moisture may be still further medicated. Thus, in some forms of erythema, and especially in inflammatory affection of the superficial lymphatics and veins, much relief is obtained by keeping the part constantly moistened with a boiled solution of acetate of lead and opium ; in the proportion of two grains of each to the ounce of water. Or a solution of belladonna may be employed.

The form of epithem is sometimes inapplicable ; the part being wholly intolerant of weight and pressure ; as in acute affections of the eye. But, when moderate weight is not objectionable, and the continued application of heat and moisture is desired, the ordinary poultice is very grateful in many cases ; made light and soft ; free from grease, and all irritants, actual or possible ; and renewed as often as maintenance of sufficient temperature requires. Nothing is more suitable for an inflamed ulcer, for a forming boil or abscess, for a recent cut in erysipelas, or for a sloughing bruise. There are many cases, on the other hand, in which it may be well superseded, by a more elegant and convenient substitute—lint, folded double, or quadruple ; dipped in warm water ; laid on the part ; and covered by a larger piece of oiled silk or gutta-percha web, which retains the heat and moisture, and prevents soiling of bed and body linen. In ordinary inflaming wounds, for example, this is infinitely the preferable form of application ; more easily obtained and renewed than the common poultice ; less odorous ; less heavy and cumbrous ; less apt to irritate by degeneration. Or the texture which is now manufactured for the purpose, and termed *epithem* or *spongio-piline*, may be employed. Or in another way heat and moisture may be used ; in the form of steam, as recommended by Dr. Macartney. In inflammatory affections of the throat, glottis, and larynx, this will be found very serviceable.

Nitrate of Silver has two modes of action ; according to the severity of its application. 1. When passed lightly, in the solid form, over an inflaming part previously moistened, the surface, if subsequently exposed to atmospheric influence, becomes black, dry, and hardened ; and the same result may be obtained by the use of a strong solution. At the same time, a mitigation of the ordinary symptoms of the inflammatory process is almost invariably evinced ; if the disease be neither very active nor advanced, and situated not deeper than the true skin. In simple erythema of the fingers, for instance, often nothing more is requisite, except local rest and constitutional care, to achieve speedy and satisfactory resolution. The effect is plainly sedative and antiphlogistic ; acting directly on the part. In making the application, care should be taken to include not only the whole extent of the inflaming surface, but a margin of apparently sound tissue besides.

Iodine, in solution, pencilled frequently on the part, exerts a somewhat similar influence. But, on the whole, it is probably inferior to the

nitrate of silver, as a direct local antiphlogistic ; although it may be, under some circumstances, a very convenient substitute. In red painful swellings of the toes, for instance, often associated with irritable corns ; and in similar affections of the skin at the roots of the finger nails, so common in washer-women—the external use of iodine seldom leaves any thing to be desired.

Light use of the nitrate of silver may be also rendered available, in circumscribing the inflammatory process when superficial and disposed to spread—as in erythema and simple erysipelas. It is applied in substance to the sound skin, about two inches from the erythematous border ; so as to form a belt, of about an inch in breadth, surrounding the extending redness on all sides ; or opposing it only on that side towards which we particularly wish the disease should not spread. In very many cases—other suitable means being, of course, not neglected—the disease advances up to this line of circumvallation ; and, failing to surmount it, becomes arrested within its confines. Care must be taken, however, not to produce vesication by too severe an application ; otherwise, the effect will probably be to hurry on extension of the redness, and to favour its transgression of the limits which were intended to fix its arrest.

2. Nitrate of silver may be applied firmly and long enough to produce vesication. An excellent means of counter-irritation ; but plainly inapplicable to affections of the very surface ; as to them it must prove a direct rather than a counter-irritant. The milder form of application cannot be employed too immediately, as regards both time and space ; indeed, the earlier and more direct its use, the more likely it is to prove successful—its effects being at once sedative and antiphlogistic. The higher dose, however, effects a plainly contrary result ; as the occurrence of vesication abundantly testifies.

Pressure, like cold, may be considered rather as a prophylactic, than as a curative agent in inflammatory affections ; if employed early and carefully. Yet even then the result is problematical. It is quite possible that very gentle, accurate, and uniform pressure may be made on a part about to be inflamed, so as to prevent the first vascular change—determination of blood ; or, even when that has occurred, it may prevent the second—dilatation and distension of the capillaries ; and thus the establishment of the vascular element of the inflammatory process may be, as it were, mechanically obstructed. But it is much more easy to imagine, that pressure is not so skilfully and successfully conducted ; that the texture is accordingly irritated, that determination to and subsequent distension of the capillaries do consequently take place, at least in part ; that the inflammatory process does begin, the prophylaxis having signally failed ; and that continuance of the pressure then only occasions a worse evil, by creating much tension, and so greatly aggravating the disorder.

The time for the safe employment of pressure is after declension of the disease ; change of structure, sponginess of texture from inflammatory product, and congestion only remaining, by reason of resolution being as yet incomplete. Then it is one of our most valued and efficient means of stimulating absorption, removing inflammatory product, and supporting the vascular walls. Yet, even then, its use must be at first cautious ;

lest it should over-stimulate the entire texture, and induce inflammatory reaccession. It is applied by means of plaster, splints, special compresses, or simple bandaging.

Counter-irritation, likewise, is seldom to be employed until all acute disease has fully subsided. During advance of the inflammatory process, as yet unbroken by suitable means, the induction of a new one by a new stimulus, even at some distance, may not only fail to afford relief, but also aggravate both the local and general disorder. The question of *time*, therefore, is an important consideration. Counter-irritation is the opponent of chronic rather than of acute disease ; and is also useful in getting rid of the results of either. *Site*, too, is important. Applied to the part itself, direct irritation and acute disease are induced therein ; an occurrence invariably untoward, unless when we wish for either destruction or thorough change of structure. And a somewhat similar result is likely to ensue, if the application be made in the too immediate vicinity of the part affected. To be beneficial, and even safe, the inflammatory process artificially induced must be at some distance from the site of the original disorder ; and yet not too far removed, otherwise the reflex stimulation it is intended to produce on the vital structures and vessels of the inflamed part may fail to operate sufficiently. There is no more valuable remedial agent than counter-irritation ; none more frequently employed, with the best results ; but it must be rightly placed and timed ; not too soon, not too near, nor yet too far away.

Exception must here be made in favour of counter-irritants of the gentlest and simplest kind—the rubefacient. They are often used early, with the best advantage. A warm poultice, or fomentation, or even a sinapism, often affords good relief at the very outset of mild inflammatory affections of the mucous surfaces—in the throat, for example—before its structure has undergone any great modification.

Remembering what was formerly stated in regard to metastasis, we can readily understand the mode whereby counter-irritation acts beneficially on an inflaming part. Marked determination of blood is produced to the skin, which, comparatively unimportant as a texture, has its vital condition so modified by the irritant as to undergo a slight and manageable amount of the inflammatory process ; and commensurately we find the deep part, comparatively important, relieved more or less effectually from what endangered both texture and function. The relief is analogous to that effected by direct stimulation of the motor centres of the *nervi vasorum*, whereby the contraction of their muscular fibre is induced, and the quantity of blood sent to the inflaming part greatly diminished ; besides an effect through the nervous system is produced on the nutrition of the cell structures of the part, whereby cell-proliferation is checked.

Counter-irritation may be varied in grade, form, and mode of application. 1. *Rubefacients* constitute the slightest class ; and are simple counter-irritants. They induce a slight modification of the nutrition of a large extent of external surface, and are thereby of use to relieve a somewhat similar condition elsewhere ; they so modify textural nutrition as to bring blood to the surface and retain it there, but do not induce further change of structure than increased collection of serosity in the tissues. Moderate heat, mustard, and various stimulating embrocations,

may be noticed as familiar examples. Of these, the mustard is probably the most frequently employed ; in the form of epithem—termed a sinapism, or mustard poultice ; made by spreading, within the folds of fine flannel or muslin, a thick layer of smooth mustard paste, made with vinegar,* and warmed before application. It is kept on until redness is fully established in the skin ; and, for this purpose, no definite period can be assigned, as the quality of mustard varies materially, and there are many individual peculiarities in this respect. Some patients retain such applications for several hours, with comparative impunity ; while to others even a brief contact is almost wholly intolerable. In children, the time of their application should be invariably brief : otherwise, they are apt to vesicate, proving more than mere counter-irritants. Indeed they may induce even gangrene, when imprudently or negligently employed, especially in the aged or where coma is present.

An excellent rubefacient has been brought into use by Dr. Corrigan ; and may be termed a minor cautery. “A thick iron wire shank, of about two inches long, is inserted in a small wooden handle ; having on its extremity, which is slightly curved, a disc or button of iron, a quarter of an inch thick, and half an inch in diameter—the whole instrument being only about six inches in length. The face of the disc for application is quite flat.” A small brass spirit-lamp having been lit, the button is held over the flame ; “keeping the forefinger of the hand holding the instrument, at the distance of about half an inch from the button. As soon as the finger feels uncomfortably hot, the instrument is ready for use ; and the time required for heating it to this degree is only about a quarter of a minute.” Should no spirit-lamp be at hand boiling water answers quite as well. Application is made as quickly as possible ; “the skin being tapped successively, at intervals of half an inch, over the whole part to which we wish to apply it ; always taking care to bring the flat surface of the disc fairly in contact with the skin. . . . In the course of a quarter of an hour, or sometimes of a very few minutes, the whole skin becomes of a bright red, and the patient feels a glow of heat over the part.”†

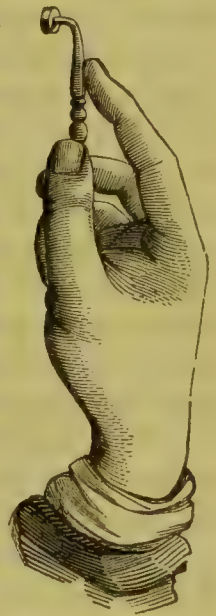


Fig. 14.

The simple counter-irritants are adapted to the milder and less advanced examples of the inflammatory process. As already stated, slight affections of the throat and air passages often yield readily to a sinapism ; assisted, perhaps, only by a purge, a sweat, and temporary starvation. As a general rule, however, it is not the less to be inculcated—in regard to the higher grades of the inflammatory process—that even the simplest

* The chemist says that vinegar is no good solvent of the principles of the mustard, which by combination produce the essential oil on which its irritant effect depends ; but experience assures us that it makes a most efficient sinapism. Perhaps the vinegar itself proves irritant.

† Dublin Hospital Gazette, 1st March 1846.

Fig. 14. Corrigan's small cautery, for rubefacient counter-irritation ; shewn in the act of use.

class of counter-irritants are not to be employed, until a comparatively late period ; when all activity of morbid change has been fairly subdued by other and more suitable means. Nor should they ever be used, without much caution, in either children or adults of a peculiarly irritable habit ; for, in the latter, they are apt to have a constitutional effect, the reverse of antiphlogistic ; and, in the former, it is possible that the cure may prove worse than the disease.

Dry-cupping may be ranked among the simple counter-irritants ; that is, the glasses being applied in the ordinary way, but without the use of the scarificator. Blood is brought to the surface and there retained, during the application, as well as for some time afterwards. The effect, as formerly stated, is obviously derivant ; but, besides, the nutrition of the tissues is temporarily modified, and if the glass is rudely rubbed over the surface very considerable irritation is produced.

2. *Vesicants* both counter-irritate and more decidedly and permanently modify nutrition ; not only bringing blood to the surface, but also producing more or less inflammatory product in the form of fibrinous serosity collected in a bleb or blister. Heat of considerable intensity ; the minor cauter, applied slowly and firmly ; ammonia ; cantharides, in the various forms of blistering paper, tissue, and liquid ; nitrate of silver rubbed hard on the part, till pain is felt, till the roots of the hairs look blue, and till the general colour of the skin begins to change—are familiar examples. They are more powerful in their effects, local and therefore reflex, than the rubefacients ; and, consequently, are adapted to oppose a higher grade of disease. Their efficacy is especially admitted in regard to the final subjugation of inflammatory affections of the serous and synovial membranes. Often, under their use, the embers of acute disease are quickly extinguished ; and inflammatory product in internal parts speedily disappears.

The simple form of the cantharides is apt to irritate the kidneys ; as evinced by strangury, sometimes severe. In affections of the genito-urinary system, therefore—more especially of the kidneys themselves—we either prefer another vesicant, such as the nitrate of silver, or employ the cantharides with much caution ; giving copiously bland mucilaginous drinks, and using one of the “*telæ vesicatoriæ*,” rather than the ordinary plaster. These profess to avoid this casualty, and often keep their promise. If very rapid vesication be desired, ammonia in a concentrated form, or boiling water, or the surface of a smoothing iron removed suddenly from boiling water, may be employed ; or the part may be covered with spirits of wine, which is then set on fire.

3. *Suppurants* prove still more highly evacuant ; by setting up such a degree of the inflammatory process in the artificially affected surface, as to establish a more or less copious and persistent discharge of pus. An ordinary *blister* may be converted into this class. At first, it discharges serosity. This becomes less in quantity, and of greater consistence, containing a certain amount of fibrin ; and at length it dries up, the part recovering with cuticular desquamation. The inflammatory process has passed gradually away. But should this be maintained, either by reapplication of the blistering tissue, or by the use of some other irritant—as tartar emetic, cantharidine, or savine ointment—the serous discharge is suc-

ceeded by a purulent secretion ; and this may be maintained by continuance of the stimulating dressing.

Tartar Emetic—already mentioned as an antiphlogistic remedy when given internally—is also of service in altogether another way as a local application ; in the form either of ointment or of strong solution. Pustules form, more or less abundantly ; usually of large size, and acute. But this application, though capable of producing much counter-irritation, has its disadvantages. The pustules do not always appear in the place rubbed, and where they are wished, but often at some distance, doing no good, and creating a great deal of unnecessary irritation—in the axilla, for instance, instead of on the arm or side. They are apt to be scattered over a large extent of surface too ; not concentrating the counter-irritant effect ; and, consequently, comparatively inefficient on the seat of disease. Besides, the artificial inflammatory process may prove excessive ; the pustules enlarge and become confluent ; sloughing may occur, and extend ; and, in consequence, the counter-irritant local effect may be merged in general excitement—an event not atoned for by absorption of the antimonial into the system. In most cases, therefore, we prefer a more mild and manageable agent.

Croton Oil, pure, or diluted with some simple oil and coloured to prevent mistake—or, better still, mixed with wax so as to form an ointment, or with liquor potassæ or ammonia to form a liniment—produces a copious eruption of minute pustules, which cluster closely together, and with care may easily enough be made to limit themselves to the part rubbed. Its effects may be varied, from mild to grave, according to the intensity and duration of its use. *Nitrate of Silver*, too, in addition to its simple antiphlogistic and vesicant effects, may be made of pyogenic virtue ; an ointment, containing ten grains to the ounce of lard, being rubbed upon the part. Pustules follow, of a manageable and efficient kind. And this application is said to be very useful in the more chronic affections of the synovial apparatus of joints.

A *Seton* affords a more copious and constant supply of purulent matter than do any of the pustular agents. It consists of a wound, chiefly subintegumental, kept open and discharging by the presence of a foreign body lodged in its track. The integuments are pinched up, and transfixed by a bistoury ; or by a broad needle, made for the purpose. To the eye of the needle, or to the eye of an ordinary probe which is made to follow withdrawal of the bistoury, a ligature is attached ; and to the ligature is connected a skein of greasy silk or cotton, or a strip of lint, intended to lodge in the wound. Poultices and fomentation are applied during the first few days, until free suppuration has been established ; then tepid water dressing, protected by oiled silk, or any simple unctuous dressing, will prove a convenient substitute. The foreign body is moved once or twice a day ; so as to favour cleanliness, by preventing lodgment of discharge ; and, by irritating, to keep up the discharge's maintenance. If necessary, it may be smeared with some stimulating ointment, or soaked in some acrid fluid, to refresh the inflammatory process from time to time.

But, instead of the skein of silk or cotton, it is in general much better to employ a caoutchouc tape ; which is to be had, manufactured

for this purpose, of various dimensions. By absorbing no discharge, it greatly favours cleanliness and absence of unpleasant odour ; and, besides, remains long entire, and does not require the painful process of renewal. It is moved to a side once or twice a day, wiped and simply replaced. The necessity for discharge diminishing, the size of the seton-tape is made proportionally to decrease ; ultimately the last thin shred is altogether withdrawn, and its track encouraged to close.

Sometimes, in the case of large setons of old standing, a clump of red, vascular, angry-looking granulations form, at one or other extremity of the suppurating track ; giving the patient much annoyance, by pain and irritation ; and sometimes emitting a considerable quantity of florid blood. They are easily got rid of, without removing the seton, by the stroke of a knife or scissors ; or by the application of an escharotic, such as the *potassa fusa*.

An *Issue* may be established either by the knife or by an escharotic. In the former case, it differs from the seton in being an open instead of a subintegumental wound. An incision is made ; and, to prevent its healing, and to insure its degeneration into a suppurating sore, a foreign body, such as a pea, is placed between the margins, and retained by plaster or bandage ; the foreign matter of course varying in bulk, according to the extent of the wound, and the amount of discharge desired. When an escharotic is used, it may be either potential or actual ; the former is the more generally employed ; and the *potassa fusa* is, on the whole, most suitable. It may be rubbed steadily on the part, until destruction of texture is effected to the desired extent. Or a portion is laid on, and retained by plaster ; which, at the same time, is made to protect the surrounding integument which we wish to leave uninjured. Or a slight incision is made ; and into that is inserted a portion of paste, composed of equal parts of the potass and quick lime. In any way, an eschar or slough is formed ; it separates, by the process of ulceration ; and a suppurating sore is exposed, on its detachment. This sore may be kept discharging, by stimulating applications ; either constantly or occasionally employed. Or it may be permitted to heal of its own accord ; reapplication of the caustic, in the same or another part, being subsequently made, if necessary. During separation of the slough, a poultice is applied ; afterwards, the water-dressing. If healing is to be opposed, some irritant is employed ; such as the Unguentum Tartratis Antimonii, or the Unguentum Sabinæ. When we wish the evacuant effect chiefly, we keep the original issue permanently discharging : when we desire to mingle active counter-irritation with copious evacuation, we prefer a succession of eschars—bringing repeated inflammatory accessions externally, as well as maintaining purulent discharge.

The *Actual Caution* stands highest in the list of evacuant counter-irritants. In former times, it was in much request by the practical surgeon ; forming an invariable part of his armamentarium in daily use ; and, at the hospital visit, uniformly found glowing in the furnace, ready for its accustomed function. But, now-a-days, it is often supplanted, happily and humanely, by milder and not less effectual means. We should be very unwilling to depart in any way from the axiom, “Ad extremos morbos, extrema remedia.” Let us act up to, and yet not exceed its rule.

During an advancing destruction of texture in the articulating ends of bone—more especially if deeply-seated—all other means of counter-irritation may, in the first instance at all events, give place to the actual cautery. Speedy arrest of such disease is our anxious desire, ere the change shall have proved irreparable; and we are culpable, if we do not at once employ that remedy which we know to be most available to the important end. In chronic affection of some of the internal organs, also, a cure may sometimes be obtained by the actual cautery, after having been denied to all other means.

The cautery may be flat, edged, or globose. By some the flat, by



Fig. 15.

others the edged form is preferred for the purpose of application. It is heated to a white heat, and rubbed or scored in lines upon the part, to the extent deemed requisite.

The lines of burn, though more painful than a moderately broad continuous slough, are equally effectual as counter-irritants; and are frequently preferred, as, on healing, they leave a much less marked cicatrix. The applying hand, in any case, should rest long enough on the part to destroy the entire thickness of the true skin; so as to avoid the very painful burn which would otherwise result, from exposure of the sensitive cutis; and it was with this view, that we specified the whiteness of the hot iron. But the application should not be so heavy as to lead to the involvement of subcutaneous parts in the separation of the eschar—an unnecessary and unwarrantable sacrifice of texture. For a few hours after the cauterization, cold is continuously applied; to allay the pain, which, though much less at first than could be anticipated, is, when inflammatory reaction sets in, very severe. Afterwards the eschar is covered with a tepid poultice.

The cautery may be applied with or without the previous induction of anæsthesia, according to the wish of the practitioner, and the capacity to bear pain on the part of the patient.

The *Moxa*, once much in vogue, has latterly fallen into comparative desuetude—scarcely deserved. It consists of either a cylindrical or conical roll of porous substance, adapted for steady and gradual combustion. It may be made of the down of the *artemisia latifolia*—the substance originally employed; or a very convenient substitute for the Chinese original may be obtained in fine cotton wadding; carefully dried after immersion in a solution of nitrate of potass; and enveloped in tissue paper, leaving the ends free. It is held in the regular portemoxa, or in the noose of a common wire, or grasped with a pair of dressing forceps. One end having been placed over or on the part to be cauterized, the other is set fire to; and ignition is maintained, by either a blow-pipe or bellows. According to the distance at which the burning mass is held from the part, the effect may be made to vary, from simple redness to actual eschar; and the latter may be in the same way

Fig. 15. The actual cautery, of its most ordinary form.

regulated, as to both extent and depth. When applied with any degree of intensity, the pain is great, as can readily be conceived—unless anæsthesia be employed ; nor is the patient's alarm and apprehension at all trifling. But one advantage certainly attends its extreme application ; viz., that, after combustion is over, the pain very rapidly subsides. The part seems to be killed so thoroughly, throughout the whole thickness of the true skin, that it is incapable of further sensibility. The surrounding skin may be protected, during combustion, by wetted lint ; but it seldom altogether escapes injury ; and is usually the seat of tingling pain, by and by aggravated by inflammatory accession. The application of cold water, immediately after the burning, is most grateful.

By this means, very efficient and very varied counter-irritation may be effected. And it was long considered a potent remedy, in chronic affections of deep-seated joints ; both of inflammatory, and of neuralgic origin. Indeed, it is not easy to understand, how latterly it should have become so much neglected ; unless it be from requiring a special apparatus for the application, and from the not unnatural disinclination, which most people possess, towards so deliberate and undisguised an application of fire to the most sensitive portion of their frame.

When employing any form of the actual cautery, in cases however suitable, let it be borne in mind that such an application may prove in itself an untoward influence on both part and system ; and its effects ought always to be carefully watched, with this fact in our remembrance. For example, it is a good rule in practical surgery, after having failed with this most powerful agent to arrest the progress of destruction in a joint, not at once to proceed to amputation, even should the hectic seem urgent ; but to attempt to obtain cicatrization as soon as possible, and wait a little. Perhaps the hectic, as well as the local disorder, may happily decline ; a fresh opportunity for other practice may be afforded ; and, after all, the limb may be saved. In other words, it is just possible that the cautery, not the disease, may have been the cause of the constitutional urgency.

Stimulants and Sorbefacients.—These, being latest of application, come naturally last in the order of enumeration. Let us suppose that an intense inflammatory attack has been first broken, by blood-letting and other sedatives and evacuants, and that its subsequent chronic lingerings have been effectually overcome by judicious counter-irritation. The part is found free from perverted function, chronic as well as acute, but still labouring under some change of structure, from which it is unable effectually to clear itself ; or, the task seeming onerous, it is, as it were, loath to begin. It is then that this last class of remedies proves highly advantageous ; restoring tone to the textures, vessels, and nerves of the part, rousing the sluggish circulation to normal vigour, and hastening the progress of absorption. If the inflammatory process have been but transient, such adventitious aid will probably not be required. The part, freed from function of a perverted kind, at once resumes that of the normal standard ; becomes its own physician ; works its own cure. But in all cases where the process has been continued, inevitably causing considerable structural change, not merely is such extraneous assistance expedient ; it is only by a patient continuance of its use that local health

can be regained. Friction, simple or medicated ; pressure, carefully regulated ; plaster, with or without bandaging ; iodine, in solution or ointment ; mercury, in the form of either epithem or inunction—are the more common examples of this class of remedies. Deferred until all excitement is over, they are also to be begun cautiously, and continued warily ; lest at any time inflammatory accession should be reinduced.

When much fluid product remains after cessation of the inflammatory attack, as in the case of the serous cavities, the best promoters of absorption are those which act upon the system, and evacuate by excretion, especially purgatives, diuretics, and the preparations of iodine, pushed as the system will conveniently bear.

Let it not be forgotten, that in all cases of advanced inflammatory change, the part long—perhaps always—remains weak ; both prone to reaccession of perverted function, and ill able to control or bear up against it. Therefore, such a part is to be carefully nursed, and protected from the more prominent exciting causes ; and, when disease does recur, we should anxiously seek for its early and complete arrest.

Now, let it not be supposed, that in each example of the inflammatory process, or even in most, the whole of the items of the foregoing copious catalogue of antiphlogistics are to be employed. That were to enjoin the running of a gauntlet, from which very few frames could escape unbroken. Selections are to be made. And it is in this practical department that a knowledge of facts triumphs over mere theory ; the practitioner tempering and guiding his theoretical knowledge by experience, judgment, and discretion. It can be readily imagined, that no definite rules can be laid down on this subject ; but the following may be stated in brief illustration. There are very many inflammatory attacks—as after wounds, bruises, fractures, burns, etc.—in the treatment of which none of the higher antiphlogistics are required. The internal use of antimony, or aconite, action on the bowels, local blood-letting, fomentation, rest, and attention to position, are perfectly equal to the remedial task ; subduing disease satisfactorily, and yet not enfeebling, even temporarily, the general powers. When an important internal organ, however, is being inflamed—as the lung, kidney, bladder—we are anxious to overcome the evil as soon as possible ; as it were, at once to cut it down ; saving both texture and function. In such circumstances, we may have to begin with blood-letting ; and even to repeat it, once and again, until the symptoms are satisfactorily subdued. When not only function of the part is important, but its texture also is delicate—the efficiency of function dependent on the integrity of that texture—as in the eye and brain, we may practise bleeding with equal alacrity as in the former instance, and follow it up by the use of mercury. In some cases, full and continued doses of antimony may be substituted for the mercury. And in some, both of these medicines may be employed ; each at its appropriate period of the case. When excruciating pain attends, and more especially if the part affected be an internal organ, our principal reliance must be placed in opium, after blood-letting has been pushed as far as the probably already depressed state of general vital power will permit. At all hazards, such pain must be subdued, if

possible. In rheumatic inflammatory affections, opium, mercury, antimony, are often secondary to colchicum, salines, and other special opponents of diathesis. For the chronic embers of an acute inflammatory attack counter-irritation is very suitable; and this, sometimes preceded by moderate local depletion, and always accompanied by complete rest of the part, is specially effectual in the cure of perverted function which has been chronic from the first—more especially in the case of the hard textures and their coverings. Again, in certain very acute affections of soft parts, we trust largely to the lancet and bistoury; as in phlegmonous erysipelas and inflammatory affections after injury. And so might examples of the efficacy of special antiphlogistics, in opposing special forms of disease, be multiplied greatly.

Treatment of the Asthenic Inflammatory Process.

Here we enter upon a very different task. There is no tolerance of the true antiphlogistics—more especially of blood-letting and mercury. The paramount fact in the disease is the tendency to depression and debility of the system, with depraved condition of the blood; and the paramount indication is to counteract this state of things. Diet is as nourishing and copious as is compatible with digestion; and stimulants, cautiously dosed, are often most necessary to spur the else flagging powers of life. The blood is bettered by iron, given freely—usually in the form of the tincture of the sesquichloride—acting beneficially on the system, on the tone of the vessels, and on the kidneys. And opiates are often advisable, to allay irritation and procure sleep. For the part sedatives and relaxants are not suitable; but active measures, with the use of the knife, often become necessary when the suppurative stage has been reached—as will be more fully explained by-and-by.

CONGESTION.

Congestion is of two forms, the *Active* and *Passive*.

Active Congestion.—This is but a part of the general inflammatory process. It may be a mere preliminary to the more advanced stage; or it may persist as the minor grade, constituting a disease of itself.

Its *Causes* are identical with those of the general inflammatory process. Whatever these may be, it is directly due to modification in the nutrition of the textures of the part affected, by which an increased amount of blood is admitted to the part, while at the same time the circulation is rendered sluggish. The *Symptoms* are such as have been already ascribed to the inflammatory process, when slightly developed, and stopping short of the suppurative crisis. Redness is considerable; heat, swelling, and pain are well marked, yet not intense; and there is little tension. More or less febrile disturbance may attend.

The *Results* also resemble those of the general inflammatory process. Resolution perhaps most frequently occurs, in the way formerly described. Or advance is made, and the minor process becomes merged in the

greater. Or the congestion simply persists, and with it occurs further change of structure. The serous product contains more or less fibrin in solution; and the increased cell-proliferation threatens by becoming permanent to induce serious results by impairing function; as in the parenchyma of an important internal organ. Or, on the contrary, such an issue may be most salutary; as in the healing of wounds and ulcers, more especially by granulation.

If congestion occur suddenly, and texture be delicate as well as vascular, hemorrhage is not unlikely. If on a free surface, as mucous membrane, no harm but benefit ensues; it is a spontaneous depletion, probably critical, and ought not to be rashly thwarted. To check such a flow prematurely may be virtually to convert, according to circumstances, hemoptysis into pneumonia or apoplexy of the lung, hematemesis into gastritis or enteritis, menorrhagia into metritis; that is, preventing resolution, and compelling advance of the disease. If, on the other hand, the vessels give way in the substance of an important organ, such as the brain or retina, nothing but evil can follow such extravasation; it is by all means to be avoided.

Treatment is gently antiphlogistic. Blood-letting from the part; general blood-letting, when the texture affected is internal and important, and especially if tendency to copious hemorrhage and extravasation be dreaded—as in the lungs; antimonials; saline purgatives; rest; fomentation; position; and the antiphlogistic regimen. Should the affection threaten to become chronic, counter-irritation is to be employed. For the morbid results, in external parts, pressure, friction, and other means of stimulating absorption, are appropriate; should the natural effort of the part, when relieved from active disease, not prove sufficient. But, usually, unless the congestion have been long sustained, all the serous or fluid part of the inflammatory results is readily taken up by the spontaneous act of absorption, so soon as the active disease has ceased. For example, much effusion may have taken place into a serous cavity; but by suitable antiphlogistics the congestion has been subdued; and, very shortly afterwards, the whole of that acute dropsy will probably have disappeared spontaneously. Thus, simple hydrocele is got rid of. The original chronic serous collection is removed, by tapping; stimulation is applied to the serous surface, by injection; acute collection of serum takes place, and distends the cavity again; but, on subsidence of the artificially induced irritation, this serum quickly disappears; and it is seldom that any re-accumulation even threatens, a healthful balance having been established thenceforth between absorption and exhalation.

Passive Congestion.—This may follow an imperfect resolution of the Active form, as the Chronic inflammatory process follows the Acute. Or it may be original, unpreceded by any active change. In the Active form, the nutrition of the textures becoming exaggerated, the circulation in the blood-vessels of the part is modified from a cause inherent in the part itself, while a tolerably vigorous circulation continues in and around; in the Passive, the obstructing cause may exist in the part, but not necessarily—the dilatation and sluggish circulation being maintained in such cases by the debilitated or depressed nutrition of the part. As the vital interchange between the textures and the blood is

diminished in those cases where the cause is local, and as in other examples the venous return is impeded, the redness is always of a dark hue; little or no heat is complained of; a sense of weight and dulness is felt, rather than pain; effusion is serous, due to mechanical causes; and the swelling differs distinctively from the inflammatory enlargement of texture, in that we have neither tension, induration, nor increased proliferation of texture; function is more or less disturbed. The characteristic symptoms, as contrasted with those of the acute form, are—the dark colour of the part, comparative absence of pain and heat, and soft doughy swelling gradually formed, influenced by position and pressure.

The *Causes* of Passive congestion may be shortly stated to be, 1. previous perverted vascular function; 2. local debility from any cause, more especially as evinced by atony of the blood-vessels; 3. obstruction to venous return; 4. alteration in the quality; and 5. in the distribution of the blood; 6. general debility. (1.) It has been already observed that the Passive form may be the consequence of the Active. The textures remaining debilitated, the arteries, capillaries, and veins continue distended and weak. (2.) Local debility, however induced—by inflammatory change, exposure to continued cold, application of poison, mechanical injury—is manifestly favourable to depression of textural functional activity, and therefore to weakness of circulation there. (3.) Obstruction to venous return by creating distension is a direct cause of venous accumulation. It may be the result of position; long maintenance of the erect posture, for example, tending to induce passive congestion of the lower extremities. Or there may be obstruction by compression; by ligature, by tumour, or by over-distension of a normal part. Habitual use of a tight garter will occasion passive congestion of the leg; and a similar result will follow the formation of tumour in the popliteal space or at the groin, as well as great and habitual distension of the lower bowel by fæculent matter. (4.) Diminution of the normal proportion of fibrin in the blood renders its fluid portion more transudable, and so favours passive effusion of fluid, should congestion, from any cause, however slight, co-exist—as from the decubitus during continued fever, or the dependent position of the legs during convalescence. (5.) Determination of blood to a part certainly produces congestion there; and if the part have been previously weak, the congestion will probably be to a large extent of the passive form. Thus an internal organ, having just recovered from inflammatory disease, with its vital power depressed, and the minute vessels still large and of weak circulation, can scarcely escape passive congestion, if the patient imprudently expose himself to cold, so as to cause decided intropulsion of blood to it from the surface. (6.) General debility, bringing at once proneness to unwonted determinations, with an easy overcoming of the extreme vessels thereby, plainly favours passive congestion. (7.) It not unfrequently happens that two or more of such causes occur in unison, rendering the establishment of the morbid condition all the more certain. Thus, the patient described under the fifth head may be of either scrofulous or scorbutic constitution; and, in his case, all the causes will probably have combined, excepting perhaps direct obstruction of the venous return. And yet that need not be wanting; he may have diseased heart, impeding pulmonic circulation;

or organic disease of the liver may seriously retard its venous flow—either circumstance frequently occurring as the more immediate cause of passive congestion, with its troublesome consequences, in the serous cavities.

Results.—1. Resolution may take place, and is to be hoped for; but, at best, it is a tardy process, and often incomplete. 2. Hemorrhage is not so likely to occur as in the active form; and when it does, it is of an opposite character—still passive; venous, dark coloured, in a quiet slow stream; but this stream, simply by being gentle and furtive, yet constant, may lead to serious loss of blood. Its continuance can scarcely be expected to benefit the part, and it cannot fail to hurt the system, already weak and perhaps exsanguine; it may usually be arrested, therefore, with but little ceremony or precaution—a practice very different from what is applicable to a similar event in the active form. 3. Serous effusion is the characteristic result of passive congestion; occurring slowly and gradually, it may be, yet accumulating in large quantity by continuance; more aqueous, by containing much less albumen and fibrin, than the similar effusion of the active form; and most remarkably less amenable to spontaneous absorption. It may take place into a serous or synovial cavity, constituting a dropsy; or into the parenchyma of a part, forming cedematous swelling.

Treatment.—1. Manifestly the first indication is to remove the cause—whether that be ligature, feculent accumulation, unfavourable position, or structural change of some internal organ. The last mentioned is, for obvious reasons, often accomplished with difficulty, if at all.

2. An obvious cause having been removed, it is well to disburthen somewhat the over-distended vessels, as the second step towards their reduction to a normal state. Punctures are applicable to the ordinary surface when thus affected; scarifications to mucous membrane. Serous effusion is at the same time permitted to escape, and thus the parenchyma is also relieved. In affection of deeply-seated parts, however, we have to rest satisfied with less direct, and probably less efficient means of obtaining this object—a derivant, instead of a directly evacuant effect. Blood is to be coaxed from the part—not so readily as in the active form of congestion—by dry cupping, sinapisms, or other simple counter-irritants; or blood may be actually drawn from the part's vicinity, in small quantity, by leeches or cupping. By either procedure—the latter the more likely perhaps—derivation is to be expected, so as to relieve, to a certain extent, the gorged and indolent vessels of the congested part.

3. The third indication—after having obtained as much relief of the part as we can—is to stimulate the nutritive activity of the part and its blood-vessels to resumption of their wonted condition and tone; so as to prevent further serous effusion, and remove that which has already taken place. Friction, at first gentle, and gradually increasing in vigour; pressure, uniformly applied, and also at first used gently—are obvious means of obtaining fulfilment of this indication. They may be happily combined; the one mechanically favouring retarded venous return, and indeed accelerating the general circulation of the part; the other mechanically promoting restoration of normal calibre to the blood-vessels; both vitally arousing the dormant energies of the part, as regards nutrition

and absorption. Contraction of the vessels may be further favoured by suitable local applications, as zinc, alum, kino, galls, catechu, etc.—especially useful when a mucous or granulating surface is the seat of the affection ; also by the internal use of general tonics, as the preparations of bark and iron. The latter class of remedies will, of course, constitute a prominent means of cure in those cases where marked general debility seems to have induced the local disorder, or, at least, to be concerned in its maintenance.

Stimuli are sometimes of use, not in procuring simple subsidence of the morbid process, but by acting upon the ultimate textures as excitants to more rapid development. Activity is thus grafted upon indolence ; and Passive Congestion may be converted into Active. Then, by abstracting the stimulus which caused the change, and employing some of the gentle antiphlogistic means suitable to the new production, resolution may be hoped for under circumstances much more auspicious. An example of this has been already quoted, as given in the modern cure of simple hydrocele. Other illustrations occur daily, in the stimulating system of treatment so successful in removing passive congestions of the conjunctiva. Care must be taken, however, that our own creation does not become worse than the original malady.

CHAPTER II.

THE HEALING PROCESS.

THE power of Nature to repair injury in the living body is the more remarkable, on account of the processes employed approaching in some cases closely in character to those which are of a destructive nature ; so that whenever, by inflammatory or other morbid change, a portion of tissue has been destroyed or separated from the body, either in molecules or in mass, we invariably find the slightest favourable change in the morbid process followed by the formation of a material adapted for healing the breach, by the development of new tissue. In the removal of sloughs and the healing of ulcers, in the separation of mortified limbs, in necrosis of bone, and even in some forms of scrofulous and malignant disease, this conjunction of the constructive with the destructive process is constantly observed ; and, according as the one or the other predominates, we have the functional disturbance which indicates disease, or the quiet succession of changes which might almost be thought normal, were it not for the abnormal character of lesion which called them forth, and for whose repair they are destined. Repair is usually painless, destruction painful ; repair accompanied by lowly or sub-inflammatory symptoms, destruction by highly inflammatory ; repair unattended by constitutional changes, destruction marked by fever and irritation. Yet as we have seen in considering the inflammatory process, these two results have features so similar, that the most minute pathological examination will often fail to detect the structural differences between them ; and the transition from one to the other is by a process so gradual and imperceptible, as to baffle all attempts to define the limits of either.

In the healing, as in the inflammatory process, there is usually, if not always, an increased cell-proliferation with production upon the surface of the injured part of fibrinous serum. But, in the former, this cell-formation takes place strictly according as it is required for the construction of new tissue, or the protection of a yet tender surface ; and does not exceed in quantity what is sufficient for this purpose. The powers of production also, which in the advanced inflammatory process are arrested, or have their results degenerating as rapidly as they are formed, are actively employed during the healing process in producing the new cell-structures which undergo plastic results ; so that pus is either not formed at all, or only produced in such measure from the superficial layers of proliferating cells as is necessary for the protection of those lying beneath.

The healing process may be studied under all its most important modifications, in the closing of any simple wound which occurs in a sound constitution, whether accompanied by loss of substance or not.

We shall find that, under different circumstances, the injury may be repaired in the following methods :—

1. *Immediate Union.* Sometimes it happens that cut surfaces coalesce at once and simply. The oozing of blood having ceased, no appreciable formation of new matter occurs ; the parts simply adhere, and become reincorporated in the normal transmutation of textures, with a scarcely appreciable cicatrix. This is rare—in man—except in the most trifling incisions.

2. *Healing by adhesion ;* a process independent of the advanced inflammatory process, and altogether incompatible with it. For its occurrence, three things are essential. That the surfaces of the wound shall be in close and uniform contact, and so retained ; that a sufficiency of normal circulation shall be maintained in the part ; and that the constructive part of the inflammatory process shall not overpass its second stage. To obtain the first, surgical manipulation and adjustment are necessary ; for the second, the existence of the ordinary essentials for healthy nutrition in the part is sufficient ; the third is the object of our especial care, in the management of both part and system. Fibrinous serosity—and then serum alone—trickles from the wound ; the surface becomes coated as if varnished with a thin layer of fibrinous lymph, investing and binding together the cut surfaces. The medium of adhesion thus formed is soon found to consist of cells and nuclei ; then fibro-plastic organization with the formation of new vessels takes place, and the uniting medium is ultimately composed of white fibrous tissue, which is incorporated with the cut surfaces on either side of the gap and restores their continuity. In some instances where apposition of the divided surfaces is very closely maintained, and circumstances are otherwise favourable, adhesion may occur with scarcely any trace of connecting material ; the divided parts uniting simply with each other, and all trace of a wound very shortly disappearing. But, in the greater number of instances, a small amount of new texture is formed ; and this is almost always, as we have said, white fibrous tissue, whichever of the soft textures of the body may have been involved in the wound. Thus skin, muscle, nerve, and even cartilage, when wounded, are united in the majority of instances by this tissue ; bone, however, being a remarkable exception to this law of the economy, as we shall see hereafter.

Some have supposed that blood may prove an organizable material, sufficient for adhesion ; and that the presence of a coagulum, between the cut surfaces, may consequently be conducive to this result. There is good reason to believe, however, that practically such is not the case ; that in the case of wounds the red corpuscles, and probably the greater part of the fibrin too, constituting the coagulum, are removed ; and that the true plastic uniting material is the result of a new, and, as it were, special formation—due to the proliferation of the connective tissue corpuscles, which have been irritated by the direct injury inflicted on them by the wound. Coagulum, when at all considerable, is really a mechanical obstacle to the process of adhesion ; and, under such circumstances, is to be surgically considered a foreign body—offending, and to be removed.

3. *Healing by growth :* a slow but most effectual mode of repair.

analogous to the ordinary function of normal nutrition. This occurs in wounds which do not obtain coaptation of their cut surfaces, and which nevertheless do not inflame and suppurate, but retain a circulation the same as in ordinary health. A plastic formation takes place on the surface, to a very limited extent; not for the purpose of repair, but rather to constitute a covering or protection from atmospheric influence, exposure to which might by its stimulus hurry on inflammatory change. The surface, thus coated, sometimes assumes the appearance of mucous membrane and distils a scanty serous secretion—usually, however, it is covered by a thick crust, or scab, which remains dry. Beneath this, and within the original textures, there advances a cellular development, as in ordinary nutrition, but at a more accelerated rate; whereby the parts slowly and imperceptibly expand, so as to efface the breach which had previously existed. There is no formation on the outside, for filling up the gap by new structure exterior to the old; all is done within the original structure, and beneath the surface of the wound. This mode is common enough in the cold-blooded animals; and, while occasionally met with in all the lower animals, is of exceptional occurrence in the human subject.

The preceding modes of cure are painless, or nearly so; effected by simple organization of plastic material, either within or without the cut surface; the advanced inflammatory process is wholly absent; there is no formation of pus; there is no waste of the plastic material, all is employed in the purposes of repair; a thin serous fluid exudes, and that in sparing quantity. Exclusion of atmospheric air, from the cut surface, is essential to them all; in the two first, this is effected by accurate and constant coaptation of the wound; in the third, by a suitable investment of the part, either of natural or artificial construction.

4. *Healing by Granulation*, or “union by the second intention.” This is the usual mode of healing in ulcers; and also in wounds of the

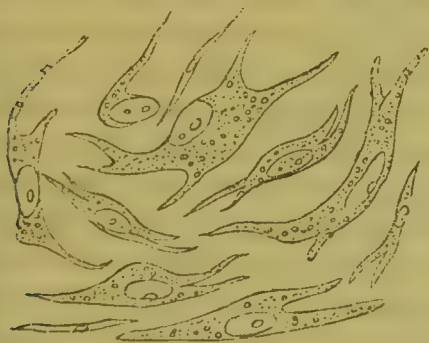


Fig. 16.



Fig. 17.

surface involving much loss of substance, and consequently followed by more or less advanced inflammatory change. The first and most essential

Fig. 16. Fibro-plastic and fusiform cells from recent formations on the pericardium. Similar cells are found in granulations.—BENNETT.

Fig. 17. Section of a granulating surface, representing capillary loops, surrounded by the corpuscular results of the hyperplasy of the connective tissue cells; these superficially undergoing plastic changes, which result in the gradual transformation of the whole thickness of plastic material into a thin cicatricial pellicle of white fibrous tissue.—PAGET.

step towards repair is subsidence from the suppurative crisis. Suppuration, no doubt, continues, but with this difference; that whereas previously all the new formation passed off in the form of pus, now only a part is so disposed of; a plastic portion remains incorporated with and superadded to the original secreting tissue, in the form of granulations—red, fleshy, vascular, minute conical eminences—and the pus serves to invest these as a protective covering. The new matter, having undergone partial absorption, then assumes the characters of fibro-plastic tissue, and becomes denser, tougher, and thoroughly vascularised.

After a time, considerable contraction of the granulating surface takes place, by reason of such condensation. The edges of the wound, originally separated by their own elasticity and the progress of inflammatory change, are again approximated. The granulations and the adjacent integumental surface come to be continuous; the latter passing smoothly into the former, which are still covered with only their own transient and fluid secretion. The permanent closing in of the granulating surface has still to be effected by cicatricial transformation of the cells into white fibrous tissue. This last part of the process of cure is termed *Cicatrization*.

Cicatrization is in truth the process whereby granulations, when on a level with the surrounding original skin, are permanently converted into a new protective covering, resembling the cuticle in function. The commencement of this process of skinning over is observed at the periphery of the granulated space, where a thin whitish-blue pellicle is seen stretching from the original skin, and gradually overspreading the raw surface; thinnest and most transparent at the margin, where of recent formation; thicker and more opaque where in contact and continuous with the healthy skin around. The space to be invested is being gradually diminished, not merely by advance of the cicatricial pellicle but by actual diminution of the space itself; and this is caused by gradual condensation, decrease, and contraction of the newly formed substance. It was by the formation of this that continuity of texture was restored; and it is very plain that, this restored continuity remaining unbroken, diminution in the bulk of the connecting medium cannot fail to bring the original parts into nearer apposition. But it is not to be supposed that, uniformly, this diminution of bulk in the new matter continues until all has been removed, and that consequently the breach becomes permanently closed merely by puckering together of the old textures. This may happen in simple wounds which heal by granulation, when there has been no considerable loss of substance, or when the original tissues are lax and admit of being drawn together; while in all cases gradual extension of the cutaneous tissues in the neighbourhood, and even to a considerable distance, produced by the powerful tendency to contract centripetally possessed by all cicatrices, materially and most efficiently assists in the work of reparation. In all ulcerations, however, where loss of substance is considerable, and where it is situated upon a dense unyielding surface, with condensation of the surrounding tissues—the extent and thickness of the new formation will be easily recognised, constituting, as it does, a complete but less satisfactory means of effecting permanent closure of the gap.

The newly formed pellicle, when completed, is termed the *Cicatrix*; at first redder than the surrounding parts, thin, spongy, and tender; but gradually becoming pale, more dense, less acutely sensitive, and diminishing in extent by the process of contraction, as just explained; ultimately, where complete contraction has taken place, it becomes depressed, puckered, and firm, not more sensitive than the surrounding parts, and paler in its hue—for its permanent organization and vascularization are less perfect. The true cutis is too complicated a texture to be reproduced in a perfect form. As has been well remarked by Mr. Travers, the new formation is only a copy, and like all copies inferior to the original.

It has been stated that the new cuticular formation commences at the free margin of the skin, and is thence centripetally extended. Such is the general rule. No points of cicatrix spring up from the granulations, and, enlarging, gradually coalesce with the advancing marginal development. In many indolent superficial ulcers, especially when these are the result of burns, there is a semblance of this; but only a semblance. Where the central islands of skin appear in these cases, the old integument had not been wholly destroyed; and it is from the remains of original *cutis vera* that such insular pellicles have been formed, not from granulations altogether recent. As a general rule, integument is formed by and from integument. But it is well to bear in mind that exceptions may and do occur. For instance, when there has been much loss of substance, undoubtedly involving the entire thickness of the cutis to a considerable extent, as in the case of ulcers, due to constitutional causes, part of the formation of the cicatrix may be effected in the usual way; or the process of ulceration may still continue extending the limits of the sore at the margin, while a cuticular film may be seen commencing at one or more points near the centre, and spreading towards the circumference. But this is to be regarded as an exception to the normal course by which cicatrization is effected.

After cicatrization is complete, the work of absorption and contraction still continues for some considerable time; gradually diminishing the amount of new texture, and sometimes, as already stated, in cases of mere solution of continuity effected by a cutting instrument, bringing the primitive tissues into almost absolute contact. The new material, in this respect, bears a strong analogy to the temporary callus in fracture.

The healing process resulting from the cicatrization of a granulating surface may be obstructed by various circumstances. The advanced inflammatory process, its most formidable foe, is fatal to it. Plastic formation is arrested. And besides, all new structures being of feeble vitality, and consequently prone to ulceration, this follows on the inflammatory reaccession; granulation is not only hindered, but undone; and what has been already raised in repair is disintegrated, and crumbles away. Nor will the process of repair be again restored, until the advanced inflammatory process, and with it ulceration, have satisfactorily subsided. On the other hand, an obstacle may arise from deficient, instead of excessive, formative power; there is a want of new material; out of nothing, nothing comes; and the chasm remains unclosed. But this part of the subject will be better elucidated, when treating in detail of the various kinds of ulcer.

CHAPTER III.

SUPPURATION.

Pus (p. 31), it has been already stated, may be formed either in the parenchyma of a part, or on its free surface (p. 32). The former condition is termed *Abscess*—of great frequency of occurrence, and of much import to the practical surgeon.

Acute Abscess—Sthenic.

When suppuration follows the inflammatory process of an acute and sthenic kind, we find the morbid state resolvable into three parts, as formerly stated (p. 33); capable of being represented by concentric rings. Within the central will be found the pus, extravasated blood, and broken-up original texture. Within the second is the fibrinous product, with more or less of the results of connective-tissue-proliferation advanced towards organization; limiting, or tending to limit, the suppuration within the central space. The third or external circle represents the diffuse serous infiltration, which invariably surrounds, more or less, the central and more important changes.

When this threefold state has continued for some time—and more especially when the duration is such as to warrant the appellation of chronic being given to the abscess—the limiting fibrinous matter becomes more and more condensed, its central aspect ultimately assuming a membranous appearance and a membranous function; having a smooth villous surface, somewhat like the mucous, from which the formation of pus continues as from a free surface. Hence it is termed the *Pyogenic Membrane*; endowed with very considerable capability of secretion, but as an absorbent surface comparatively feeble. In regard to this latter point, however, it may be useful to remember that the pus globule is of comparatively large size, not soluble in its own serum, and therefore, unless it becomes disintegrated through fatty degeneration, incapable of ordinary absorption; the serous portion of pus may be taken up readily enough, but the solid part probably remains but little affected. And thus the apparent feebleness of absorbent power may depend, not so much on defect of either structure or function in the pyogenic membrane, as on the nature of the fluid containing organic structures on which it has to operate.

Sudden suppression of purulent formation is always to be regarded as an untoward event. It is more liable to occur in the case of free and open suppuration, than in an unopened abscess. It may be the result of some accidental occurrence, the nature of which we may be unable at the time to ascertain; or it may be caused by injudicious stimulation applied to the part, reinducing the inflammatory crisis, and for a time at least arresting secretion—even of a morbid kind. The suppression, however

induced, is liable to be followed by irritative fever; usually of a formidable character, and with difficulty allayed. Or, on the other hand, the local result may follow on the general. A patient labouring under a discharging wound may become the subject of febrile accession, altogether independent of the previous affection; and, during persistence of such fever, the purulent as well as the other secretions will be either arrested or impaired. Whatever the cause of purulent suppression, there are few events that bring more serious and well-founded alarm to the practical surgeon. As will be afterwards seen, it is often connected with the condition termed *Pyæmia*.

The usual course of an abscess is to enlarge, and to approach the surface. The purulent is a waste fluid—a destructive result of the inflammatory process—containing only aplastic, or kakoplastic cell structures, in the sense of being incapable of advancing to higher organization—to all intents and purposes a foreign matter, and must be removed. We have just seen that it is little liable to absorption; the only other alternative of removal is by direct evacuation. In most cases, this should be the work of the surgeon. But Nature has a mode of her own, and is to a certain extent independent of his interference. In contact with acutely formed pus, the surrounding parts soften, and tend to disintegration, more or less; which is aggravated by the pressure which the accumulating fluid cannot fail to produce. Ordinarily, however, such destructive progress does not break through the limiting barrier of plastic matter, but continues to be surrounded by it, in more or less completeness. The work of destruction and the effort of repair abide in their original relation; but do not advance uniformly, and in all directions alike. The former tends to the surface; and unless thwarted by structural difficulties, reaches it by an aperture of discharge.

This process is termed *Pointing*, and always occurs in the direction where there is least resistance to pressure. Its further explanation is difficult. And instead of attempting to assign any explicit reason for its “seeking the surface,” it is probably better simply to announce such outward tendency of pus as a well known and admitted law. The progress is various; sometimes rapid, sometimes protracted and tedious; depending on the intensity of the inflammatory process, on the rate of fluid accumulation, and also on the nature of the intervening parts. If these are of a fibrous structure, we know that they will long resist the advance of the abscess, and consequently retard the progress of the pent-up matter beneath—almost always injuriously. The ordinary areolar tissue, on the other hand, gives way readily and rapidly. Ultimately the skin alone resists. This becomes attenuated, stretched, and completely deprived of its support, for a certain space—usually of no great extent; for the abscess enlarges in a conical form, its apex towards the surface. The stretched and undermined portion of skin may slough, and be quickly detached; or becoming more and more attenuated, the scarf-skin in the centre of the pointing integument alone remains for a time entire, and at length peels off. The aperture formed in either of these ways admits of the pus being discharged.

As the matter becomes superficial, its existence is indicated by what is termed *Fluctuation*. The fingers are applied over the part lightly;

and by what looks like alternate pressure, but is really produced by keeping one finger still while another is made to press lightly but steadily on an opposite point, the impulse communicated through the fluid is more or less distinctly perceived; the more superficial, thin, and copious the matter, the more marked its impulse. When, on the contrary, the pus, yet recent, is but scanty, and the superimposed texture both thick and dense, the sensation imparted is obscure. Experience and acuteness of touch are both required, under such circumstances, to prevent mistake in diagnosis. The surgeon possessed of both, with the additional faculty of using them aright, is said to be endowed with the *tactus eruditus*—a gift of rare value. The adipose tissue, when abundant and somewhat tense, has an elasticity which simulates rather closely the fluctuation of abscess. The junior practitioner should, by frequent practice, early learn to discriminate between the two sensations. And as opportunity offers, let him not neglect to contrast also the elasticity of the medullary tumour; many examples of which imitate accumulation of fluid still more closely.

But the progress of matter is not always to the external or integumental surface; it may be to the mucous. When the integument is either distant, or separated from the pus by dense fibrous texture, the pointing of the abscess takes place not only in that direction, but also towards a mucous outlet should this be in the vicinity. Sometimes, even, the matter opens upon a serous surface; but this is fortunately a rare result. Thus, when matter has formed immediately exterior to the peritoneum, in the abdominal parietes, although the dense unyielding fibrous texture on the external aspect interferes with its progress to the surface, yet the support afforded to the peritoneum from within is so equable, that in almost all such cases the outward progress is steadily maintained through the more dense, thick, and unyielding investment; the peritoneum for at least some considerable time remaining entire, and saving the abdominal cavity from dangerous purulent irruption. Whereas, when abscess has formed deeply in the areolar tissue by the side of the rectum, very often before it has pointed externally on the hip it has made its way by an ulcerated aperture into the cavity of the bowel. And, in the same way, abscess of the lung, or even of the pleura, is more likely to be discharged through the bronchial tubes, than to make its way through the thoracic parietes.

Especially important tissues—the arterial, venous, and nervous—may traverse the cavity of the abscess; or, though at first not implicated, may be eventually exposed to the matter's contact by enlargement of the suppurated space. Such parts are protected; at least for a time. They are incrustated by a fibrinous layer, dense and compact; which maintains the nutrition of the texture, and thus saves the important part which it invests from ulcerative destruction. Only for a time, however, be it well remembered. For should the relieving incision be unwisely withheld, the extensive denudation of important parts will almost certainly be followed by destructive ulceration, with the complication of hemorrhage when the abscess has opened.

The *Symptoms* which accompany and denote the formation of abscess are sufficiently plain. These are the ordinary signs of the inflammatory process—pain, heat, redness, and swelling. Centrally, the swelling is

soft and fluctuating; exterior to the soft suppurated centre, is the hard unyielding barrier of fibrin; and exterior to both is the soft, diffused, pitting swelling from serous diffusion (p. 82). As the matter accumulates and points, fluctuation becomes more distinct, the central soft space enlarges as well as becomes more prominent, the surrounding induration recedes, the general swelling assumes a more conical form, and towards the apex of the cone the redness gradually passes into a yellowish tint, the pus shewing its own colour through the attenuated integument.

Throbbing and increase of pain, in general, immediately precede supuration; and, especially when seated in important parts, rigor usually marks its occurrence. Should the inflammatory process then subside, as it frequently does—as if exhausted in the effort of having attained to its crisis—and if the suppurated texture be loose and yielding—the uneasy sensations, though not wholly absent, decidedly abate; and, afterwards, on the thin portion of skin giving way, they are still further relieved. If, on the contrary, as formerly shewn (p. 33), the tissues be dense and unyielding, or the inflammatory process from any cause sustained, the pain, throbbing, heat, and tension are undiminished, or probably rise to an aggravated intensity.

The constitutional symptoms are inflammatory in the first instance; and then these either simply subside, or change into those of hectic, as formerly explained (p. 33).

Treatment.—The indications to be fulfilled in the management of acute abscess are—1. To moderate remaining inflammatory disease. It has been already stated, that, on the formation of matter, the morbid process which caused it often subsides spontaneously. If not, antiphlogistics are to be continued. 2. To remove all sources of excitement from both system and part. The former half of this indication is met by maintenance of the antiphlogistic regimen; in regard to the latter, foreign matter is taken away, muscles are relaxed, and the part is so placed as not to be ruffled or otherwise irritated from without. 3. To encourage the matter's approach to the surface. For this, nothing is so effectual as the constant application of hot poultices, frequently renewed, along with maintenance of strict quietude of the part; and at each renewal of the poultice, hot fomentation may be used for some minutes. The hot and moist applications are of use antiphlogistically; and besides, by favouring relaxation of texture, they promote enlargement of the suppurated space—whereby, as we have seen, approach to the surface is effected (p. 61). Tension and undue pressure are also avoided, which otherwise might occur, reinducing the inflammatory attack. 4. To evacuate the matter by an early and free opening. Abridging nature's efforts by artificial means. 5. To subdue the fresh disturbance which the infliction of the wound must necessarily induce. Fomentation, poultice, and rest, are still adequate to this. 6. To promote the ultimate closure of the cavity of the abscess by granulation and cicatricial contraction.

The three first indications are not to be long persevered in, ere the fourth is arrived at. Three or four days at the utmost—sometimes only as many hours—will suffice for fomentation and poultice; and then, as soon as fluctuation can be detected, evacuation should be effected.

It is no doubt true that nature is herself equal to overtake this result, unaided; and the mode of her operation we have shewn (p. 83). But the completion of that task, often laborious, should seldom be demanded of her in acute abscess; otherwise harm must accrue. 1. Time is unnecessarily wasted. Nature's mode of evacuation is a gradual and tardy process; the plunge of a knife is the work of an instant; and it may happen, not unfrequently, that time is all-important to the patient. 2. An unnecessary amount of pain is endured. Though after suppuration of lax textures the painful feelings usually subside, yet they do not disappear; not unfrequently pain continues even severe, and is not really assuaged until (by evacuation of the matter) pressure and tension have been effectually removed. The pain of opening may not be slight, but it soon passes away; it is but as a moderate cost of a most valuable purchase. And if chloroform be employed, no pain need be felt at all. If the suppurated texture include what is fibrous, osseous, or otherwise unyielding, pain is invariably aggravated instead of being abated by the formation of pus; and therefore the expediency of early evacuation is still more obvious under such circumstances. 3. Texture may be greatly endangered. In the ordinary progress of an acute abscess, favourably situated, the majority of the surrounding parts are pushed aside, condensed, and infiltrated by fibrin and serum; while at one point actual destruction of texture takes place, by the disintegration of the connective tissue which occasions the process of advance. But if the natural effort outwards be baulked by resisting texture, as it is almost certain to be in deeply seated abscess, then pressure is increased to a dangerous degree, at other and various points; and those parts which otherwise might have been merely displaced, and temporarily altered in structure, now become the prey of a morbid process which is destructive. Areolar tissue is broken up, muscles are separated, periosteum is detached, bone stripped bare may ulcerate or die, cavities and canals are opened into,



Fig. 18.

blood-vessels may be perforated, joints may be stiffened or destroyed. Such evils may occur, even when the process is gradual and of a normal kind, preceded by its fibrinous barrier; but it may happen that disintegration becomes unusually rapid, and the boundary of fibrinous product is broken down; purulent formation then takes place diffusely through the tissues, and both the

extent and rapidity of disaster are fearfully increased. 4. The danger is not only local but general. Such destructive results, as have just been alluded to, cannot occur without involving the system in serious disorder. This would be the case, even supposing the parts so injuriously dealt with to be of themselves unimportant. But they



Fig. 19.

Fig. 18. Danger of delaying incision, exemplified. Thumb lost in consequence.

Fig. 19. The illustration carried further; after maceration.

may be such as in their lesion to peril existence almost immediately ; hemorrhage may occur from a large artery or vein ; there may be violent inflammatory seizure of an internal serous cavity, by purulent irruption ; or the patient may be choked by the pus, in an effort of bronchial escape.

It has long been admitted that open abscesses undergoing acute ulceration—in fact changed from the condition of abscess, into that of an acute and spreading ulcer—may expose and perforate blood-vessels, and other important canals. But the power of unopened abscesses to do likewise would seem to be by many doubted, if not denied, and made an excuse for delay in evacuation. That occult abscesses, however, have such destructive power imparted by circumstances, not only does theory admit as possible, but experience declares as a fact. In deep abscess of the neck, for example, when pus is bound down by the dense cervical fascia, it is no very uncommon thing, when nature is culpably left to struggle unaided under such adverse circumstances, to find an opening taking place into either the

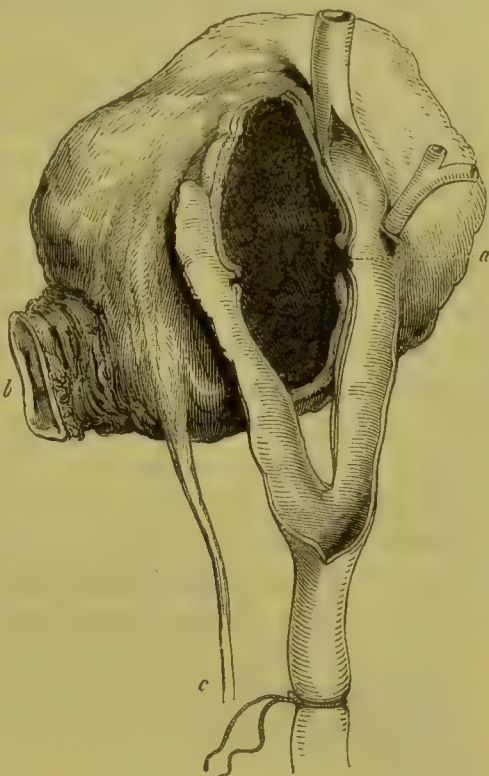


Fig. 20.

oesophagus or trachea ; and recent examples have not been wanting of still greater hazard, by perforation of either the carotid or the internal jugular.* In the one case, a form of False Aneurism is established ; in the other, the train is laid for troublesome, and it may be fatal hemorrhage.

It is worthy of note, in a practical point of view, that such suppurative lesion of the vascular tissue is especially apt to occur in young people after Scarlatina ; and that, in the open condition of sore, the vein is more apt to suffer than the artery. It may be added, that a chronic abscess which, after having attained to some size, has suddenly become acute, is specially dangerous in this way ; all the more if blood-vessels of

* British and Foreign Review, No. 29, p. 155 ; and Medico-Chirurgical Transactions, vol. 25, 1842 ; also London and Edinburgh Medical Journal, March 1843, p. 177 ; *Ibid*, April 1843, p. 386 ; *Ibid*, July 1844, p. 632 ; *Ibid*, April 1845, p. 265 ; Lancet, No. 1025, p. 130 ; *Ibid*, No. 1228, p. 287 ; *Ibid*, No. 1377, p. 92 ; Liston, on a Variety of False Aneurism, London, 1842 ; Liston's Practical Surgery, London, 1846, p. 189 ; Monthly Journal, Feb. 1852, p. 110 ; *Ibid*, March 1852, p. 277, etc. These are but some of the appropriate cases ; there are others. One seems especially conclusive ; in which the aorta, where in contact with an unopened abscess, was found ulceratively eroded *from without* ; the inner coat alone remaining, attenuated yet entire.

Fig. 20. Mr Liston's case. *b*, the external opening of what was an abscess. *a*, the ulcerated communication between the cyst and the carotid artery ; the latter has been sliced open. *c*, the par vagum.—British and Foreign Review, No. 29, p. 155.

any size happen to lie between the abscess and its approach to the surface.

In former times, *maturation* of an abscess was talked of, as an event always to be waited for, and made to precede artificial evacuation. It was held as almost a maxim in surgery, that ere a knife could with propriety enter the cavity of an abscess, this should have attained to a certain size, not inconsiderable, and have become quite superficial. Such delay may be suitable enough in the case of suppurated areolar tissue, almost or actually subcutaneous; yet time and pain might both be saved even here. And from what has just been stated, it is very obvious that in all cases where the abscess is either deeply seated, or in the vicinity of important parts, to practice delay is only to incur neglect and invite disaster. The general rule, therefore, undoubtedly is to make an early and free opening in acute abscess; time and texture are saved, and pain and peril avoided. And another rule, arising out of the preceding, is—that in a truly acute abscess, cure by absorption of pus is not to be calculated on in the treatment. People no doubt say that “abscesses are absorbed.” So they are; but not abscesses which are *acute* and *sthenic*. Chronic abscesses disappear, often enough, with a whole skin; so do acute serous and lymphous collections, simulating abscess; but, as a general rule, genuine abscess, acute and sthenic, follows but one course, and that is pointing and discharge.

In some cases, it is advisable to go a step further. When we are quite certain that matter must form in the inflaming part, and when we know that highly important textures are involved, it may be wise and well to make a very early wound, down to the centre of the suppurating texture; not with the view of evacuating pus already formed, but in order to afford a ready and safe exit to the pus which we know is about to be secreted there. Thus, for example, urinous infiltration may be prevented in deep abscess of the perinæum.

Under certain circumstances, however, we purposely delay evacuation; that is, when our object is to obtain destruction of a part. In obstinate glandular enlargement, for example, which has resisted discussion, we usually endeavour to obtain suppuration. Were we to

open such an abscess early, the glandular tumour might after all remain entire and as obstinate as before; but in order to ensure its disintegration, we delay the opening, that the pressure of the pent-up matter may act destructively. Evidently, this exception corroborates the general rule, which is converse.

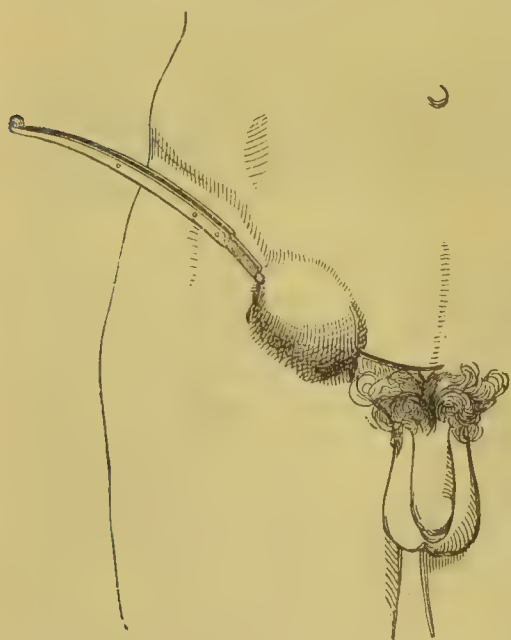


Fig. 21.

Fig. 21. Abscess opened, from within outwards—Bubo.

Opening may also be prudently delayed, when the suppurated part is in itself unimportant, and when much active inflammatory progress exists around—likely to be aggravated by early wound; as in some cases of acute bubo. Then it may be well to wait till the part has calmed down; as tooth-extraction is wisely postponed, until the fury of the gumboil shall have passed away.

The opening may be effected either by knife or by *potassa fusa*. In the great majority of cases the former is preferred, as less painful; more expeditious; entailing no loss of substance; and less likely to excite and maintain inflammatory progress which might extend and aggravate the original mischief. The preferable form of cutting instrument is the bistoury, sharp-pointed, with a fine edge, and either curved or straight. The curved is used when an abscess is superficial and prominent; puncturing the superimposed textures at their lowest and most dependent point, traversing the cavity of the abscess as far as may be deemed requisite for free evacuation, emerging from a puncture opposite to that whereby entrance was effected, and then by a rapid withdrawal of the instrument dividing the parts interposed between the points of entrance and exit.

The straight bistoury, on the other hand, is used when the surface is flat and the abscess deep. The point is held perpendicular to the surface, and steadily advanced through the superimposed parts, until the cavity of the abscess is reached—as is indicated by absence of resistance, and the freedom of motion which the knife's point may be made to assume; then by a gentle sawing movement, the aperture is made sufficiently wide ere the instrument is withdrawn. The bistoury should be held very loosely, and with readiness to let go on the instant, should the patient by an involuntary start jerk forward the punctured part. Also, when the thickness to be cut through is either considerable, or preternaturally dense, sudden plunging of the knife should be guarded against; by employing steady and gradual, rather than great and sudden force; at the same time resting the back of the bistoury on a finger of the left hand laid flat on the integument; otherwise the cavity of the abscess may be completely transfixed, and important parts wounded on the opposite side.

The opening should invariably be made dependent; that is, at the lowest part of the cavity; in order that it may afford a free and efficient drain for the purulent fluid, and thereby not only prevent re-accumulation, but also favour contraction of the empty space. And in determining the point which is most eligible with this view, we must of course always take into consideration the posture which the patient is to occupy during

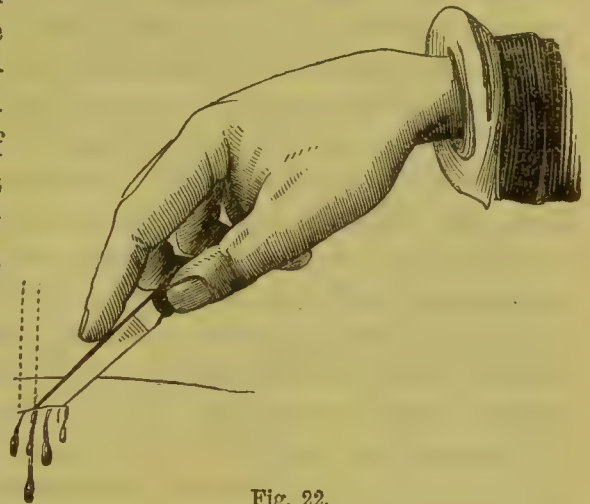


Fig. 22.

Fig. 22. Abscess opened, from without inwards.

the cure ; what is dependent in the erect posture, may not be so in the semi-erect or recumbent.

When abscess forms in the immediate vicinity of large and important blood-vessels, as in the neck, it may be alleged, in excuse for delay, that early incision cannot be made in such circumstances, without risk to the vessels. It is not so. The abscess is a safe protection from the point of the bistoury ; being usually interposed between this and the vessels—the latter on the further aspect. They may be injured, it is true, by a reckless plunge of the knife, or by an unnecessarily extensive thrust : but such things are not contemplated in the hands of a duly qualified practitioner. Any considerable quantity of matter having formed, in immediate contact with the common sheath of the large blood-vessels of the neck, an incision may be made fearlessly down on the ordinary and normal site of these parts, without dread of hazard. In the case of an early incision, the abscess protects the vessels—from the knife's point ; when opening is delayed, the abscess may become their destroyer—by its own agency.

When the incision has been made through a considerable thickness of parts, there is a chance of the line of wound uniting prematurely ; ere yet the cavity of the abscess has closed, or its interior ceased from purulent secretion. Re-establishment of the abscess necessarily results. To avoid this, such premature union is to be prevented ; by the lodgment of a foreign body in the track. However simple and slight such foreign matter be, it is sufficient to prevent adhesion. A thin slip of lint is gently inserted with a probe, and retained. All stuffing and cramming of the wound is not only unnecessary, but injurious ; painful at the time, and sure to excite subsequently a grave amount of inflammatory accession, followed by new and more extensive suppuration.

Squeezing of the part, after incision, is equally reprehensible. Much unnecessary pain is inflicted, and the inflammatory process is not only maintained but aggravated ; a fresh exciting cause is applied. If the opening be dependent and free—as it should be—the matter will find its way out readily enough.

So soon as the knife is withdrawn, and the more immediate gush of pus removed, a soft warm poultice is applied ; and into this the fluid continues gradually to ooze. But should the wound shew a tendency to bleed unduly, the poultice should not be applied until the flow of blood has ceased. When the contents of an abscess are of a flaky and semi-solid consistence, as often happens in patients of tubercular tendency, the aperture should be especially free, so as to facilitate and insure an effectual discharge.

Poulticing is continued until the inflammatory process which attended on the suppuration, and which has been somewhat increased by addition of the fresh stimulus of incision, satisfactorily abates ; until the textures have been sufficiently relaxed, and purulent discharge fully established ; such discharge seeming often to have a resolute effect. But poulticing may be, and often is, overdone. If continued after decadence of the inflammatory attack, harm is done by over-relaxing texture, maintaining congestion, and consequently prolonging redundant discharge ; pus, too, may come to occupy infiltrated parenchyma, where but serum or lymph

was before—more especially if the inflammatory process happen to be of asthenic tendency.

A part constantly sodden by a hot and moist poultice cannot be otherwise than congested. There is no doubt that many open abscesses, and many suppurating wounds, are kept from healing, and an exhausting or hectic effect produced on the system, by an undue continuance of poulticing. The first two or three days, after opening, usually suffice for subsidence of the major part of the inflammatory process ; and then the poultice is to be superseded by simple water-dressing, applied tepid ; not with an antiphlogistic view, but merely protective, soothing, and abstergent. A piece of lint, doubled, steeped in tepid water, and gently squeezed, is placed softly over the suppurated part, and covered by a portion of oiled silk or gutta percha of larger dimensions ; the object of the latter being to secure the epithem in its place, to retain also its heat and moisture by prevention of evaporation, and to prevent soiling of the bed or body-clothes by oozing. This lint is removed as often as cleanliness and comfort demand ; not oftener ; “*nimia diligentia*” in such matters is but sorry surgery, as will be afterwards explained.

The progress towards cure is usually as follows. After opening, inflammatory accession occurs in and around the abscess, by two exciting causes ; the injury inflicted by the knife, and the stimulus, not inconsiderable, caused by sudden contact of atmospheric air with the interior of the abscess—a part previously altogether unaccustomed to such influence. This fresh attack is usually subdued in a few days, by rest, fomentation, and poultice : but not before important change has been thereby effected. It induces ulceration in the exposed surface of the abscess ; disintegrating the pyogenic membrane, when that exists. But the inflammatory accession being transient, so is the ulceration ; fibrinous formation continues, and through subsidence of the inflammatory process assumes the plastic form : a portion, upon the surface, still passes off in pus ; but the remainder, adhering to the surrounding original texture, becomes organized, and converted into granulations. And these occupy the place of the pyogenic membrane, or of the fibrinous matter which was being transformed thereto—for, in recent acute abscesses, time may not have been afforded for completion of the membranous change. In other words, a suppurating surface, with destructive tendency, is exchanged for what is granulating and reparative.

But it is not by the formation of new matter that closure is principally effected. The surrounding primary textures, which had been condensed and displaced during the formation and enlargement of the abscess, being now relieved, by a vital resiliency seek their normal condition. Formerly they receded ; now they practise a directly reverse movement—centripetal. And thus by a simultaneous occurrence of this resilience of the original tissues, with the formation of a granulating surface, the cavity of the abscess partly collapses, partly contracts ; and the granulating surfaces, where in contact, unite and coalesce. Cicatrization, by the formation of a marginal pellicle, advancing towards the centre, now closes the aperture by which the abscess had opened or been evacuated, and thus the last part of the process of cure is completed.

During the progress of these events, water-dressing is applied, tepid.

Should the character of the granulations indicate debility, the application is to be medicated; variously, according to circumstances, as will be afterwards explained. Reaccessions of the inflammatory process may take place; these are to be carefully guarded against, and, when they occur, combated by the usual means. When the site of abscess is deep, care must also be taken that the superficial portion do not close prematurely; by occasionally interposing a slip of lint, or other dressing, so that the contraction may proceed uniformly, from the bottom upwards. Should the part become pale and flabby, with secretion of thin pus, and tendency of this to accumulate and remain in the cavity, general support of the part by bandaging is advisable. At the same time, the system should be looked to; and will probably be found to require support likewise.

In certain exceptional cases, caustic is preferred to the knife. In a small chronic abscess, in which opening has been delayed, the integuments are attenuated to a considerable extent at the most superficial point. On discharge of the matter, they have not power sufficient to recover cohesion with the parts beneath; and perish sooner or later, either by ulceration or by sloughing. The use of caustic under such circumstances not only opens the abscess, but, by at once destroying the feeble and thinned integument, expedites the healing process. Or, in addition to such a state of matters, obstinate glandular enlargement may exist; abscess having formed in the areolar tissue around it. Were evacuation to be performed by incision, this gland would continue to project centrally from the wound, and thereby delay, or perhaps altogether prevent, cicatrization; besides, when the pus contained within the gland is known to contain a specific poison, it is an object to get rid of that pus, perhaps also neutralizing its effects by the action of the caustic, and so removing a serious obstacle to healing. Let the caustic which effects the integumental opening be thrust into the gland in one or more places, and the result is a suppuration which is innocuous. Also, if a patient decidedly object to the knife's use, from timidity or prejudice, and unwisely shun one pain to incur a greater, caustic may be employed. The best form is the potassa fusa, pressed firmly on the part till the abscess is entered; moved laterally, also, if need be, to destroy integument; or pushed deeply, to break up glandular enlargement. Oil or vinegar is then applied, to neutralize the redundant alkali; so saving the surrounding parts; and the whole is covered with a poultice.

Chronic Abscess—Sthenic.

The formation of chronic abscess is a comparatively slow process, in all respects; most liable to occur in those of feeble constitution; and produced by inflammatory disease which is either chronic, or subacute and transient. The attendant symptoms—redness, pain, swelling, tension, heat—are comparatively trifling; some of them may be altogether absent; and the progress, whether superficially or in any other direction, is slow. Indeed it is probable that in the truly chronic abscess, enlargement of the sac is not effected or attended by ulceration, but merely by displacement of surrounding parts; unless, indeed, acute accession supervene. There

is little or no surrounding formation of fibrin, further than what constitutes the pyogenic membrane; and by this circumstance the extension of that membrane, along with condensation of the surrounding parts, is manifestly favoured. The pyogenic membrane, being more leisurely formed, is more fully developed, more highly organized, and probably possessed of both absorbent and discerning power to a higher degree than in the acute abscess. The pus is thin, its serous portion predominating largely over the globules; and this circumstance, conjoined with the greater efficiency of the lining membrane, renders the contents of a chronic abscess comparatively much more amenable to absorption. We have little hope of curing an acute abscess without evacuation; in the chronic, discussion is not unlikely to prove successful.

Sometimes the liquor puris is absorbed, while the solid particles remain in a compact and condensed form. Such an occurrence, for example, is by no means uncommon in the testicle.

Chronic abscesses are found to vary, from the smallest size, to cavities capable of holding two or more pints of fluid. When deeply seated, the very indolence of their nature ensures their attainment to huge dimensions, should their progress be unqualified by treatment. In all cases, approach to the surface is slow; for the accumulation of pus is very gradual, and, as already stated, there is comparatively little surrounding fibrinous product to hem in the secretion as it does accumulate—circumstances which render the occurrence of tension and pressure all the more improbable. Hence it is characteristic of the collection to enlarge almost equally in all directions, without the tendency to point which is observed in acute abscess.

Treatment.—When the abscess is *small*; stationary, or nearly so; or of itself shewing signs of recession by absorption; and more especially if so situated as to render the avoidance of deformity by cicatrix extremely desirable—discussion is by all means to be attempted. The general system is to be put in good order, particularly as regards the secretions; the patient is to be denied much liquid of any kind, and enjoined to live sparingly on dry food; and exhalation may be at the same time increased. For seeing that the blood must, in its normal state, be more or less serous in character, the frame may be in some degree compelled, as it were, to maintain this essential condition by absorption of its own fluids. The iodide of potassium—or some other preparation of iodine—is administered internally, beginning with small doses; and a direct stimulant to absorption is applied to the part. This last indication may be variously fulfilled. The Emplastrum gummosum, or the E. Hydrargyri, or a plaster composed of equal parts of each, may be applied; or the surface may be lightly and repeatedly blistered. Or the preparations of iodine may be used; in the form either of ointment or of solution. Experience is somewhat adverse to the former, more especially when combined with friction, as it usually is; over-stimulation is apt to occur, and chronic disease may be converted into acute under unfavourable circumstances. It is better to pencil the part frequently with the ordinary tincture of iodine, or with the following solution: Iodine, a scruple; iodide of potassium, two scruples; water, an ounce—increased or abated in strength according to circumstances. Usually the skin

becomes brown, cracks, emits serum, and is somewhat painful ; but such uneasiness, when merely integumental, is not to arrest the use of the remedy ; for, usually, while such is the state of the surface, the soft tumour beneath is found to be satisfactorily diminishing. Often thick crusts of hardened cuticle form during the use of this application ; becoming only partially detached. They should be removed from time to time, so as to expose the recent formation beneath to the thorough operation of the remedy. A sea-voyage, more especially when somewhat protracted and rough, has been found effectual in discussing small chronic abscesses ; as in the neck, or groin.

When a small chronic abscess is not stationary, but steadily enlarging ; and more especially when it is situated in an important neighbourhood—it should receive the same treatment as if it were acute. That is, free, early, and dependent incision ; leaving the part to granulate and cicatrize.

Many a chronic abscess, even of *considerable size*, may be got to disappear gradually by absorption, under the patient continuance of local and constitutional treatment.

Chronic abscess, when *large*, and refusing to yield by absorption, may be treated in two ways. 1. It may be dealt with as if acute. But in this there is some danger. The extensive internal surface is certain to inflame, under the double stimulus of wound and admission of atmospheric influence ; and this inflammatory attack is apt to be of a violent and intractable nature. Acute ulceration takes place, with discharge of much unhealthy matter, usually more or less mixed with blood ; and there may also be diffuse suppuration extending into the tissues around. Constitutional irritation, of a grave kind, necessarily follows such local mischief. And, accordingly, after incision, the treatment should for some days be very soothing, watchful, and guarded, as regards both part and system ; that such disaster may if possible be avoided, or at all events limited to a moderate and tractable form. After the period of danger has passed, the ordinary treatment of a granulating wound is to be pursued ; bearing in mind that constitutional support will be sooner required than in the after-management of acute abscess.

But when, in the case of a large chronic abscess, the state of system is such as to indicate intolerance of inflammatory invasion, along with susceptibility to its attack—as is often the case—the other mode of treatment should certainly be attempted.

2. Our object is, by a subcutaneous and valvular form of wound, to prevent atmospheric contact with the interior of the cyst. A puncture, merely through the skin, is made at the distance of an inch, or an inch and a half, from the point at which we intend to penetrate the cyst. Into this wound a finely-pointed long trocar and canula are inserted, and pushed gently along beneath the integument ; until, having reached the point of puncture, an elevation of the handle plunges the instrument through the pyogenic membrane. Assured of the canula's extremity being fairly lodged in the cavity of the abscess, we cautiously withdraw the trocar ; and the pus escapes. This having been effected, the canula is then removed—the forefinger of the left hand following closely on its re-

treating point, so as to shut up the wound, and effectually prevent the admission of air. The wound's orifice is then covered with simple and tenacious dressing. Nothing is better than a small portion of porous lint, saturated in collodion, which is made to dry rapidly ; and which, when dried, forms a protecting crust, at once adherent and impermeable. The track is likely to close by the first intention. With the view of preventing the admission of air, it will be prudent, in most cases, to withdraw the canula, while the pus is still flowing freely ; leaving the cavity of the abscess but partially evacuated. It is during the saltatory interrupted gouts, at the end of complete abstraction, that air is so apt to enter. It has been proposed, in order to make the procedure more certain, to perform such manipulations under water, or to withdraw the matter with a suction syringe ; but due attention to all the steps of the operation, as just described, will render all other precaution quite unnecessary.

While the contents of the abscess are being gradually removed, moderate and uniform compression should be applied to the part ; and, after healing of the wound, this external support should be for some time continued. The precaution is as necessary as in tapping for ascites. If it be neglected, in the case of a large abscess, serious internal hemorrhage, by giving way of venous or capillary coats in the walls of the sac, may occur ; or the admixture of blood, acting as a foreign body, may kindle the inflammatory process which we are so anxious to avoid. By such pressure, also, centripetal contraction of the surrounding parts, along with shrinking of the pyogenic membrane, is favoured ; and purulent accumulation is thus vitally as well as mechanically retarded.

When reaccumulation has occurred, we do not wait for any approach to the former dimensions ; but at an early period repeat the valvular tapping, at a different point, or at the same—should that seem preferable. One or two repetitions may be required, ere the disease is overcome. But, on the other hand, after even a single performance, especially, according to Velpeau, if tincture of iodine has been injected into the sac, the cavity may have wholly contracted, and absorption may have removed the remaining component parts of the abscess—solid as well as fluid ; or the abscess may have so far diminished in size, as to render recourse to the ordinary treatment, by direct incision, both safe and suitable.

Should the valvular mode fail ; that is to say, should inflammatory mischief supervene, instant transition must be made to the other mode of procedure. A free and direct incision must be made into the abscess, so as at once to evacuate all the contents. The subsequent inflammatory accession will probably be severe, and perilous to the system ; yet it is to be unhesitatingly encountered, as the less of two evils. For were closure of the oblique wound maintained under such circumstances, the constitution would be certain to suffer to a much greater extent. A bad kind of purulent fluid is formed ; the general contents of the abscess undergo chemical as well as vital change, in consequence of the presence of atmospheric air ; and if such matter be kept pent up, absorption of noxious material, both in the gaseous and fluid form, is inevitable, inducing a grave amount of irritative fever, probably tending towards a typhoid result.

Sometimes—indeed not unfrequently—the cavity of an abscess contracts only to a certain extent ; and then becomes stationary, or begins to extend in an opposite direction. This may happen in the acute form ; but is much more likely to occur in the chronic. The opening which was originally dependent, and sufficient for effectually draining the whole space, may in consequence become insufficient ; and a new aperture—or *Counter-opening*, as it is termed—consequently becomes necessary. It is made in the same way as the original opening ; its site being chosen so as, along with the original, to command a complete drainage of the cavity in every part. It may happen that when the abscess has been large, undulating in its outline originally, or prone to subsequent extensions, two or more such counter-openings may be required. In abscess of the scalp, for example, a plurality of wounds is often essential to efficient drainage.

Chassaignac inserts small caoutchouc tubes, in abscesses which are large and irregular, with a view to thorough drainage, as one would tile-drain a field. Sometimes the lodgment of these foreign bodies produces hurtful irritation ; in other cases, the practice is not unsuccessful. On the whole, however, the skilful use of the opening and counter-opening, with support and stimulating injection, renders such mechanical appliances unnecessary.

Sometimes the cavity fails to contract obliteratively, notwithstanding that the opening is in every way suitable. It may be that the patient's system is so exhausted, that while pus continues to be discharged, the surfaces do not unite, granulation being defective, and the centripetal movement of the original textures exhausted. Under such circumstances, we desire to excite a fresh inflammatory stimulus by acting on the part, or on the system, or on both ; hoping thus to obtain an increased supply of plastic material fitted for repair. If there be but one opening, stimulating injections, varied in strength according to circumstances, may fulfil the indication, aided by pressure. If there be two openings, a few threads of silk may be passed through, and retained in the track for some days, after the manner of a seton. At the same time the general system is suitably attended to.

Sinus.

When the cavity of an open abscess has by contraction dwindled down into a mere canal, lined by a perfectly-formed pyogenic membrane, the condition is termed a Sinus. The discharge is thin, containing few globules ; and resembling rather a depraved mucous than a truly purulent secretion. Left to itself, this state of matters might continue for a very long period.

The first thing to be done, is to ascertain the extent and form of the sinus. For this purpose, the ordinary silver probe is used ; blunt-pointed, and pliable ; and passed with all gentleness, yet with a curious care—so as to avoid perforation of previously sound texture, at the same time obtaining an accurate cognizance of the existing space. The former error is chiefly to be guarded against ; as being both the more serious and more likely to occur. The probe has not unfrequently been

passed forcibly beneath sound fascia, or through intermuscular tissue previously unbroken; and, on withdrawal of the probe, the knife has followed in the artificial track, making a cruel wound where no wound was required.

Treatment of Sinus.—We are first to inquire whether there exist a cause whereby complete closure of the abscess has been prevented. Such will not unfrequently be found. It may consist of foreign matter lodged in the part; introduced from without—and perhaps the cause of the original abscess, as well as of this subsequent degeneration; or it may be a decayed portion of the frame itself—as dead portions of bone, tendon, or fascia; or it may be formed by perversion of a normal secretion—as salivary, urinary, and intestinal concretions, escaped from their original site. If lodgment of such matters have induced the original inflammatory disturbance, it is not unlikely that they may escape along with the first contents of the abscess, when this is freely opened, whether artificially or by Nature. For such is the mode which she adopts for their extrusion; matter is formed around them, and with this they are floated out, as it were, through the evacuating aperture. But the extrusion may either fail altogether, or be but imperfectly performed; and any foreign body, remaining impacted in the part, will not fail to prevent entire contraction of the open abscess; so establishing the condition of sinus. When such palpable cause can be found, accounting for the origin and continuance of this morbid state, it is in the first instance to be removed. In effecting this, by probe, forceps, or scoop, some little injury is necessarily inflicted on the parietes of the canal; they bleed, are painful, and inflame; and the inflammatory process may be in such degree as to promote active granulation. After extraction of the foreign matter, therefore, it is well to wait a little; for this act may of itself prove sufficient to establish a cure. If not, stimulating injection may afford the aid required, in the way formerly mentioned.

Still failing, pressure is had recourse to; not carelessly applied, but with a little management, suited to the end to be obtained. In the first place, we presume that the extent and form of the sinus, or sinuses, have been accurately ascertained. Over the track is applied a well-fitting firm compress; retained by bandaging, so as to make direct and tolerably severe pressure on the whole of the secreting surface—severe because intended to irritate the pyogenic membrane. The desired inflammatory result having been obtained, pressure is removed, until the destructive process subside into that of repair. Then it is reapplied and continued, but with much less intensity; the object being merely to afford support to the granulating surface, and prevent accumulative retention of purulent fluid.

Should pressure fail—as it may do, the part being so dull as not sufficiently to obey the stimulus—then a more severe remedy awaits us; incision. Again supposing the probe to have been carefully and skilfully employed, it is followed by a probe-pointed bistoury; whereby the sinus is to be laid open. Usually it is superficial, and consequently not in the near neighbourhood of important parts; hence such wounds, even when extensive, are seldom attended with troublesome hemorrhage. Should blood-vessels, or other important textures, lie in the way, they are of

course to be avoided. The incision will certainly be followed by an acute inflammatory process throughout its whole extent; for to ensure this, and prevent adhesion at any point, a slip of lint is placed in the track, and retained until suppuration is established. The secreting surface is converted into the condition of an ordinary granulating wound, and we have only now to tend this process; making sure that it advances steadily and uniformly from the bottom, by preventing premature closure of its surface.

When sinus is both deep and extensive, it is neither necessary nor expedient to incise its whole space. A counter opening or openings having been made, treat the surface, at least in the first instance; and the probability is, that the inner portion will join the surface in the inflammatory and curative results.

Fistula.

By this term is meant a further contraction of the sinus, with consolidation of its walls, and generally complicated by communication with a mucous surface. The abscess has now degenerated into a mere tube, often presenting a pouting, sometimes a callous or warty orifice. The discharge is still watery; but ever and anon purulent reaccessions are apt to ensue.

For this state of things there is almost always a maintaining cause; to be found and removed. Some foreign substance is lodged, as in sinus; and is to be taken away; by incision, if necessary. Or there may be some change of structure at fault; the result of a former inflammatory process. Thus, *Fistula in perineo* usually depends on stricture of the urethra; and if this latter be removed by suitable treatment, the fistula cures itself; it gradually closes and dries.

If, on removal of the maintaining cause, the fistula still remains open, then the lining membrane is destroyed, and contraction favoured, either

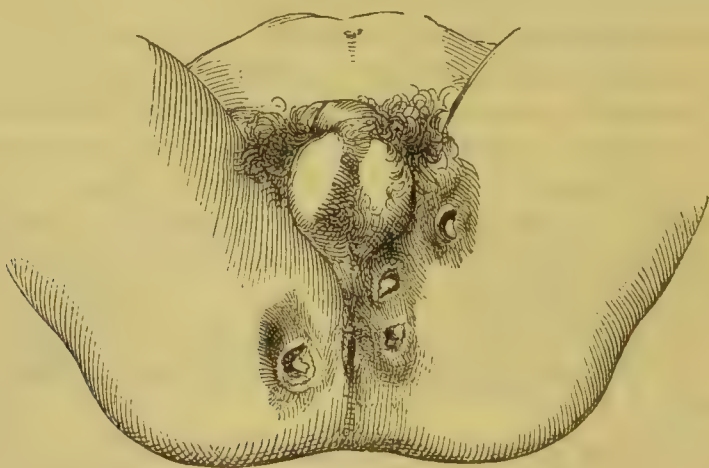


Fig. 23.

by the use of incision as in obstinate sinus; or—what is often better—by a heated wire, applied accurately to the track. In the eschar the lining membrane is included; and, on its separation, the granulating surface of a burn remains—sure to bring contraction in its healing, as

Fig. 23. Example of *Fistula. F. in perineo.*

will afterwards be seen. One application may suffice. If not, repetition is made ; but only at long intervals. It is the second effect of the burn that we desiderate—not the first ; healing and contraction, not sloughing and ulceration. A rapidly repeated use of the cautery would but enlarge the aperture we seek to close.

Constitutional Treatment of Abscess.

Throughout the whole of such local management of abscess, and its results, it is most essential that the state of the system be duly regarded. During progress and persistence of the inflammatory process, antiphlogistic regimen is enjoined, and a selection probably made of some of the simpler antiphlogistic remedies—as aconite or antimony, with moderate purging. When the suppurative stage has been fairly established, all lowering agents are to be dispensed with ; and by and by support is given to the system, that it may bear up under the discharge, and the tendency to hectic which that necessarily induces.

Treatment of Hectic.—Hectic fever, the nature and symptoms of which were formerly considered, may be connected or not with suppuration ; most frequently it does occur in connection with the exhausting discharge, or with the structural change in important parenchyma which suppuration usually occasions. Whatever the cause, it is very plain that this, if apparent and capable of being removed, should in the first instance be taken away ; or, at all events, that means should be adopted towards the attainment of this end. Thus, if the febrile disorder attend on a copious discharge of pus from a large surface, as after direct incision of an extensive abscess, our object will be to moderate this discharge ; and, by favouring granulation to the best of our ability, to expedite contraction and cicatrization. This will be effected by such management of the part as has been already mentioned ; supporting also the system by food and tonics.

Were it in our power to obtain sudden drying up of a purulent discharge to which the system has been long accustomed, we should not avail ourselves of that privilege ; knowing that such an event would be almost certainly followed by an irritative fever of a formidable kind.

If the hectic cause be hopeless change of structure in a limb, connected or not with suppuration, it is removed by a more summary procedure—amputation ; for it is better to lose a part of the body than the whole. The shock of such an operation, on a frame already worn and weak, is no doubt considerable. Yet it is surprising to observe how well it is usually borne ;—as if Nature had for some time contemplated, and even desired, to part with the diseased portion of the frame ; whose loss, consequently, creates less disturbance than in the case of traumatic or other sudden amputations. When the shock has passed, amendment is commonly found marked and satisfactory ; the pulse may have fallen twenty or thirty beats ; all the febrile symptoms have abated—and may not return.

For some time after an operation, undertaken for relief of an urgent hectic, life may quiver in the balance, lightly poised. The cause for anxiety is great. Yet the treatment should be mainly expectant. The

judicious surgeon is often content to remain a passive though anxious spectator : he knows that the affair is much too delicate for the interference of his comparatively clumsy hand, and wisely does little more than await the far more dexterous working of Nature. The inexperienced and unskilful, on the contrary, is likely to deem it his duty to be then as well as at all other times busy ; he plies sedatives, restoratives, tonics, stimulants ; and, in consequence, the balance may be quickly turned—but not in favour of the patient.

What may be termed the general treatment of hectic, is conducted according to the principles formerly explained. The system is succoured by food and tonics ; mild opiates are given to procure sleep, and calm restlessness and other nervous excitement ; mineral acids to check profuse perspirations ; astringents to check the tendency to diarrhœa ; and stimulants, should sinking threaten to ensue. Never forgetting, in regard to the last mentioned class of remedies, that all depends on their mode of exhibition ; if in large doses, with long intervals between, the fatal issue is likely to be accelerated ; it is from small doses only, oft repeated, and each carefully watched in its effects, that a fortunate event can be expected.

Diffuse Abscess, or Purulent Infiltration—Asthenic.

Abscess is said to be diffuse, when the suppuration is not surrounded and limited by plastic product ; and when consequently the pus—in such circumstances of a thin, apparently unhealthy, and perhaps acrid nature—is always found irregularly infiltrated or diffused among the textures ; with a result most disastrous to the part, and oppressive to the system. Areolar tissue is broken up, disintegrated, killed : integument is undermined, and subsequently sloughs ; and the suppurated space is rapidly and greatly extended. For, the suppuration acts as a fresh exciting cause of an asthenic inflammatory process, similar to that from which itself sprung ; and so the process of suppuration and destruction may be prolonged almost indefinitely. This is bad enough, supposing the affection to be limited to the surface ; but it is apt to extend in depth as well as superficially ; and the deeply-seated result is all the more serious, in proportion to the greater importance of the parts implicated. The attendant constitutional symptoms are those of irritative fever, sometimes typhoid.

Treatment.—The local indications are—1. To arrest the inflammatory process, if possible, ere it has reached the suppurative crisis. This is difficult. For the disease is asthenic, and the progress is rapid essentially ; else the surrounding and limiting circle of fibrin would not be deficient. The resolute attempt is to be made, however, when circumstances permit, by antiphlogistics suitably employed. 2. When matter has formed (and too often it does form, in spite of our efforts to the contrary ; and, more frequently still, it has formed before our attention is called to the part) our object is to evacuate what is already there, to arrest the inflammatory process and thereby prevent further purulent formation, thus to save the surrounding parts from destruction, and to grant an opportunity of escape to that portion of texture which may have already perished. All

this can be accomplished by one proceeding, and by that only—incision. A bistoury is passed freely into the infiltrated part, throughout its whole space ; making one or more wounds, according as the extent of the infiltration may demand. The fluid already formed readily escapes, and along with it a considerable quantity of blood ; by this bleeding the vessels concerned in the morbid process are directly rifled of their contents ; the probability is, that the inflammatory process will in consequence subside ; and subsequent formation of pus in the part originally affected, as well as continuous extension of the disease to neighbouring parts, will be either diminished or altogether arrested. After bleeding has ceased—the amount carefully regulated according to the circumstances of the case—a light poultice, or the water-dressing, is applied. Suppuration for a time is tolerably profuse ; for ulceration is necessarily in progress, to detach the areolar tissue which has perished. In no long time, however, the slough is separated, and comes or is brought away ; granulation is begun, and if matters advance favourably the discharge becomes less copious and more laudable, the wounds heal, and cicatrization is duly completed.

In this disease, it is plain that incision should be practised at an early period ; so soon as we are satisfied that suppuration is begun. The longer the delay, the greater the danger to texture, and the more serious the disorder of the system. This mode of local bleeding, too, is the most likely means of arresting the advancing process, and so preventing suppuration altogether, except at the mere line of wound ; a practice which will be more fully stated when treating of phlegmonous erysipelas.

After incision, the local treatment is for an ordinary suppurating wound ; applying early, gentle, and uniform support by bandaging, to prevent further infiltration of accumulated discharge ; favouring cohesion of the partially undermined parts, now freed from their foreign fluid ; and accelerating the general process of granulation.

The Irritative Fever is best treated by effectual and early removal of its cause ; that is by the local management just detailed. Often little else is required. During the first period of the symptoms, antimony, belladonna, or aconite may be given cautiously ; softening the pulse, and allaying those symptoms of the febrile disorder which border on the inflammatory type. Afterwards—nay sometimes from the very outset—iron is given in full and sustained doses, with food, tonics, stimuli, as circumstances may demand.

Secondary Abscess—Asthenic.

By *Secondary* or *Consecutive Abscess* is meant the formation of pus, not in the onward course of an inflammatory attack ; but during its recession, or after it has altogether disappeared. The event is more frequently observed in connection with the erysipelatous than with any other form of inflammatory affection ; and more frequently in hospital than in private practice. An Erysipelas—it may be of the simplest kind apparently—has run its course ; all trace of it is rapidly fading away ; or even some days may have elapsed since there was any sign of the disease either in part or system. The patient feels, and is thought,

well and recovered. But, unexpectedly, a shivering occurs, the pulse again rises, and the tongue fowls and dries as before; fever advances; and soon our attention is directed to painful swelling, either in the part originally affected, or at some distance from it. In erysipelas of the face, it is in the loose texture of the eyelids that we may expect the swelling; in erysipelas of the thigh it is on the inside of the limb, or in the groin; in erysipelas of the arm, it is on the inside of this, or in the axilla. But a few hours before, all may have seemed quite healthy; now the bulge is considerable; it is full of pus, usually of a thin kind; and the collection is rapidly on the increase; areolar tissue readily giving way before it, and skin becoming undermined; for the disease is asthenic, and there is a want of limiting new matter. Such abscess may be single; sometimes there is more than one. Most commonly, the plurality is not contemporaneous but successive. One is opened to-day; another shews itself on the morrow; that, too, is dealt with, and a third appears. I have seen in one limb twelve such abscesses, in less than the same number of days. If neglected, they rapidly enlarge, ultimately giving way; and serious constitutional irritation may follow. If opened early, suppuration usually ceases to extend, and the wound speedily contracts and heals.

The cause of these formations it is not easy to determine. Often we have to blame—and that on good grounds—an accidental crowding of the ward, and an unhealthy season.

Whatever the cause, the disease is both troublesome and formidable. With a view to prevention, the erysipelatous patient is tended carefully, during convalescence, and after; the state of the general secretions being specially regarded. Admission of pure air is most important; and, if need be, for the fulfilment of this indication, change of locality is enjoined. So soon as the swelling appears, opening should be instantly practised; and in the after-treatment, it is to be remembered that the part will soon shew an intolerance of fomentation, poultice, and other relaxing remedies. Constitutionally, there will be little need for antiphlogistics; alteratives and tonics come in their stead.

Since the chalybeate treatment of erysipelas has come into general use, such formations are both less frequent and less formidable. The tincture of the sesquichloride we believe to be the best preventive of the abscess, as well as the best tonic alterative when such suppuration has occurred.

Pyæmia, or Purulent Poisoning.

By this term is understood a peculiar and formidable constitutional disturbance, secondary to suppuration, and supposed to be dependent on the admixture of poisonous matter in the circulating blood—at all events connected with a specially depraved and unwholesome condition of that fluid. It changes colour, loses coagulating power, and the microscope detects an unusual quantity of white corpuscles. At one time it was very generally assumed that these were the corpuscles of pus, and that on the direct admixture of these with the blood the disease essentially depended—hence the name. But difficulties occur in connection with this theory. 1. It is impossible to tell the difference between pus-cor-

puscles, the white corpuscles of the blood, and the corpuscles formed by the lymphatic system. 2. Pus, according to both experiment and observation, may be mixed with circulating blood, without pyæmic results, 3. The entrance of pus may not be so easily effected as pathologists at one time supposed. The corpuscles cannot pass through the vascular coats by absorption. Venous orifices in suppurating wounds will ordinarily be occluded fibrinously, else hemorrhage would occur; and therefore the pus can scarcely be expected to pass into these, funnel-fashion. But, on the other hand, acute ulceration may open a vein, in connection with an acute advancing suppuration, more especially if asthenic, whether open or occult; and where blood comes out, pus may go in. And if it be true, that in "suppurative phlebitis" the internal coat of the vein pours out pus or puriform fluid, which, if it happen to find the cardiac outlet of the vein unoccluded, cannot help pushing its way into the circulation—a condition of things that some modern pathologists deny, but which has not yet passed from the belief of others—an explanation of the probability, at least, of direct purulent admixture, is plainly afforded.

But while free internal suppuration of the veins is doubted by some, another important pathological change in that tissue is quite undeniable; the formation of coagula, or fibrinous clots or plugs, which breaking down mechanically, or softening under a decomposing morbid change, may be swept off into the current more or less copiously. In the one case, the solid fibrinous particles would not fail to become arrested in the capillaries, and by their obstructive influence these might account, so far, for the rapid formations of pus in internal parts, which form so sad and characteristic aggravation of this disease; in the other, the fluid result of the softening, unwholesome, and even perhaps putrescent, mingling with the blood, would explain the deterioration of that fluid, and the onset of the grave typhoid symptoms.

Predisposing causes, it can be readily understood, are much concerned in the invasion of such evils; and they are such as are common to all unhealthy products of inflammatory disease; unhealthy season, unwholesome and insufficient food, crowding of patients in ill-ventilated wards, unskilful dressing and treatment of wounds, antecedent disease of a prostrating kind, etc.

The symptoms have been graphically described by M. Sedillot:—"A patient is attacked by suppuration; when suddenly, either without any premonitory symptom, or some days after a hemorrhage, a diarrhoea, a diffuse inflammation, a phlebitis, an erysipelas, or a painful engorgement of a wound, a more or less violent shivering fit comes on. Frequently there is observed a general trembling, chattering of the teeth, a drawing in of the limbs towards the trunk, and a morbid diminution of temperature of the skin; speech is difficult, the words uttered being short and interrupted; the eyes are hollow, and the features contracted; the countenance is of a leaden or yellowish colour; the respiration frequent; the pulse small, soft, and rapid, and an instinctive sense of great peril is presented. The shivering ceases after a period varying from ten to forty-five minutes; the warmth of surface returns, and a slight transpiration is established. Erratic shiverings, however,

return, and not unfrequently at the same hours as in the first instance ; the wound dries up, or the suppuration becomes greyish and fœtid ; the surfaces of wounds assume a withered, flabby aspect ; the bones become denuded, and ill-conditioned ulcers arise or extend. The patient seems as if exhausted by fatigue, and plunged into a kind of *coma vigil*, with occasional delirium, or into a deep stupor ; the inspirations are made laboriously, and become more and more accelerated, so that thirty, forty, and fifty per minute are counted ; the breath exhales a purulent odour ;* subcrepitating *râles* are heard in the chest, the air also not seeming to reach the minuter bronchial ramifications ; the skin becomes daily more earthy, yellowish, generally as if jaundiced ; articular pains, with swelling and intro-synovial effusion, manifest themselves successively in the various joints ; one or both of the calves may become the seat of † considerable swelling, attended with great suffering ; and sometimes severe stitches in the side of the chest force cries from the patient. The tongue becomes dry ; the lips and teeth are covered with a fuliginous paste ; the belly is tender, the pulse tremulous and rapid, subsultus agitates the limbs, the eye looks dull, the cornea has lost its polish, the bladder is no longer emptied, partial paralyses may manifest themselves, the voice is lost, and the patient dies from the fourth to the eight day in a state of extreme emaciation, and after a prolonged struggle. These are the most common traits of purulent infection, but it is seldom that we find them all present.” “ Any wounded person having a suppurating wound, in whom irregular shiverings, difficulty and frequency of respiration, a leaden or icteric colouring of the integuments, great prostration of strength, and sudden wasting, manifest themselves, is in our eyes, the subject of pyæmia. We would deliver the same opinion, if, in the absence of shiverings, the above-named symptoms were present, together with a drying of the wound, or a changed character in its discharges. The existence of an ascertained phlebitis allows of our pronouncing upon the invasion of pyæmia, the moment the local symptoms become complicated with shivering, prostration, yellow colouring of the integuments, and altered respiration. Arthritic pains and effusions, disorders of the nervous system, the typhoid appearance, induration, or abscess of the calves, etc., etc., add but additional degrees of certainty to our diagnosis.” ‡

After death, abscesses are found in the lungs, liver, spleen, brain, kidneys, heart, pleura, joints, muscles, subcutaneous areolar tissue. § The lungs are by far the most frequent site ; and there, in addition to suppuration, patches of less advanced inflammatory change may also be found. Of muscles, the sural mass, the deltoid, and the pectorals, are those most frequently involved. Wherever situated, such abscesses are

* This smell of the breath resembles that of hay, freshly mown, and of a sweet flavour.

† In the original it is “ *peu* considerable ;” but, according to my experience, the “ *peu* ” should be an error of the press. The swelling is often great.

‡ British and Foreign Medico-Chirurgical Review, October, 1849, pp. 354-56.

§ The following is M. Sedillot’s statement of comparative frequency. In 100 cases of Pyæmia, the lungs are affected in 99 ; the liver and spleen, in 1 out of 12 ; the muscles, 1 in 15 ; the heart, 1 in 20.

almost never single: internally, they are seldom even few in number; sometimes they may be counted by hundreds.

Treatment is more hopeful in prevention than in cure. Avoiding the exciting causes of erysipelas and phlebitis; moderating ulceration in sores; keeping wounds light and free; having no crowding of wards, community of dressings, or sources of mephitic vapours—in short, rigidly enforcing hygiene.

For the constitutional symptoms no fixed plan of treatment can be laid down. We are guided by the general therapeutic principles applicable to irritative fever. Opium and support are given from the first; and iron is not neglected. Quinine, in some cases, manifestly checks the rigors, and may be given with advantage when the stomach will bear it. More recently the *liquor chlorinii*, and chlorate of potash, administered internally, have been believed to be adapted to check the blood poisoning, and the sesquicarbonate of ammonia to be calculated to prevent the formation of fibrinous coagula in the circulation.

Prognosis is doubtful. Some few patients emerge happily; bearing nothing but the scars of external abscesses; others escape with life, but permanently damaged in both trunk and limb; the most sink and die.

CHAPTER IV.

ULCERS.

THESE are breaches of continuity effected by ulceration ; and may occur in any texture, though in some more readily than in others. At present, we have only to do with those which affect the surface ; chiefly situated in the skin, or in the areolar tissue beneath, and seldom implicating the deeper parts. They are every-day occurrences in the practice of surgery ; and as such are apt to be regarded lightly by the student, or perhaps even by the junior practitioner. But all should be made early to know how egregiously they err, in such an estimate of what in truth constitute one of the most important classes of disease with which the surgeon has to do. The very frequency of their occurrence renders it eminently necessary that our art should be well prepared with efficient remedies ; more especially when it is remembered, that these accidents are most likely to befall those whose limbs are of greatest value. The rich man, even when otherwise unhealthy, is comparatively exempt from ulcer of the limbs. He is well fed, so far at least as bulk is concerned. His time is very much in his own hands ; and he can take care of himself, if he will. But the poor labourer is too often ill-fed, ill-clothed, hard-worked ; all day in the erect posture, often wet and weary, and liable to external injury in the exercise of his calling. It is in such members of the community, that by far the greater number of ulcers are found ; and usually of a formidable kind. Should the disease threaten in the rich man, he takes council forthwith ; the suitable remedies are employed—of which perhaps rest and position are the most important ; and, in a few days probably, the part is cicatrized. But the poor man cannot afford to do so. His limb is ulcerated no doubt ; but as yet it is not very painful, and he works on ; it gets worse, but the erect posture is still practicable, and it is maintained ; and often only after the sore has both inflamed and sloughed, rendering motion and the erect posture at length impossible, does the sturdy-hearted peasant abandon his labour, and apply for relief. In proportion to the reluctance of his application, is his anxiety for cure. His children depend upon his exertions for food ; and if the period of treatment prove protracted, pinching poverty will too surely be their lot. Thus a heavy responsibility may be almost daily thrown on the practising surgeon ; which he must be fully prepared to meet, else his portion cannot well be one of either happiness or contentment. And as the right understanding of a disease is, at least in one sense, half its cure, we proceed to the consideration of this subject in detail.

There is no more serious error than that of exclusively treating disease by name, and in the abstract ; instead of inquiring carefully into the nature of each individual sample, and bringing forward remedies appropriate to each sign or symptom, as they occur. And there is every

reason to believe, that such careless generalization in practice is found to affect the treatment of no disease more frequently than that of ulcers. One lotion, one ointment, or one plaster or poultice, comes to be regarded as quite a panacea ; and is used in all cases indiscriminately—whether for benefit or hurt being a mere matter of chance, with the average of probability leaning towards the latter. To avoid such injurious haphazard in treatment, it is essential that we understand, thoroughly, the nature of all the varieties of sore. And, towards this end, there is nothing so useful as a right classification ; each variety shewing its distinguishing characters, and bearing at the same time its appropriate treatment. Not that we mean to designate each as a separate disease, but only as a separate variety of the same disease—ulcer ; entreating the student to remember, that in the treatment of such affections much care and watchfulness are required ; inasmuch as they have a great tendency to pass from one form into another, often by no very gradual and protracted transition ; and that, consequently, an application which is altogether suitable one day, may on the next become very inappropriate.

Classification.—The following will be found to include the great majority of ulcers. Under one or other of the varieties every example may be arranged. 1. The simple Purulent, or Healthy healing sore. 2. The Weak. 3. The Scrofulous. 4. The Cachectic. 5. The Indolent. 6. The Irritable. 7. The Inflamed. 8. The Sloughing. 9. The Phagedænic. 10. The Sloughing-Phagedæna.

1. *The Simple Purulent, or Healthy Sore.*

This is in truth an example of healthy granulation ; supervening on wound or abscess, or on inflammatory disintegration of a part previously unbroken in its surface. The discharge is thick, creamy, easily detached from the granulations, almost inodorous, not too profuse ; in fact it is *laudable* pus. The granulations are numerous, small, acuminate, florid, sensitive, vascular ; if touched at all rudely, they bleed and are pained ; the blood is arterial, neither profuse nor abnormal in quality ; and the pain is but the just appreciation of injury done to a healthy part, not the extreme and persistent nervous impression of morbid irritation. The general sensation in the part, when not injured, is slight tenderness, or a feeling of rawness, rather than actual pain ; not unfrequently, a sensation of itching is present, to an extent even troublesome. The granulations, when brought to a level with the surrounding skin—partly by subsidence of this from the state of inflammatory engorgement, partly by their own elevation—remain at that level ; and the process of cicatrization is forthwith begun. At this stage, the integument surrounding the granulating surface has a slight tumescence ; and is a little more red than in ordinary health, being more vascular. Its free margin is fringed by the grow-

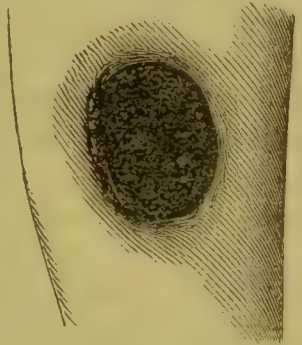


Fig. 24.

Fig. 24. The healthy sore ; in process of cicatrization. Pellicle of new skin represented round the margin.

ing pellicle of the advancing cicatrix ; usually paler than the original skin. If the granulations are long uncovered, except by pus—whether on account of the large extent of granulating surface, or any other circumstance tending to protract cicatrization—the almost inevitable result is a degeneration in the character of the ulcer ; which comes more or less to resemble the second class, whose characteristic is debility. This circumstance is very much affected by situation ; the nearer to the centre of circulation, the more rapid is cicatrization, and the less tendency to degenerate. A sore on the leg is slower to heal, and more apt to become weak, than one in other respects similar but situate on the arm ; an ulcer of the trunk is more favourably disposed than either.

Treatment.—This is simple, as is the nature of the sore. The part is placed and retained in a state of repose ; and in such a position as at once to relax the muscles implicated, and favour venous return. Simple tepid water-dressing is applied ; the pledget of lint not larger than is sufficient to invest the raw surface. Its object is simply protective ; assisting the purulent secretion in this, until the cuticular formation is complete. When symptoms of debility ensue, it must cease to be simple, and become stimulant by medication.

When the granulating space has been diminished to a mere spot, adventitious protective aid is often well superseded by an effort of Nature ; the secretion coagulates, and forms a dense, blackish, impervious, callous crust, under which the healing process steadily advances. It may happen, however, that even then discharge is redundant ; and if such be the case, while the crust is on all sides adherent, the circumstances are unfavourable. The sore has, in truth, been converted into a superficial abscess ; and the confined matter, by pressure on the tender and recent surface, re-induces ulceration there. The part becomes hot, painful, red, and swoln ; the crust is elevated and tense ; and, on its separation, an ulcerating cavity is exposed. The possibility of such an occurrence, therefore, is always to be borne in mind ; and the part examined from day to day. A slight touch of the crust will suffice to tell whether matter be accumulating beneath or not, and if it be, the crust must be gently removed, and water-dressing resumed. If there be no accumulation, Nature's protection is left undisturbed ; it ultimately separates of itself, and on its falling away a completed cicatrix is disclosed.

The natural crust may be artificially imitated, if itself slow to form ; by passing nitrate of silver lightly over the part, so as to coagulate the secretion, and then leaving this to harden and dry ; or superadding, to become incorporated with the crust as it hardens, a small portion of fine lint or charpie. Or on a slight stroma of charpie a crust of collodion may be formed.

Or the water-dressing—simple or medicated, according to circumstances—may be continued until the end of the cure. But then comes the question, not unimportant, how often is such dressing to be renewed ; the oiled-silk raised, the lint taken away, the redundant discharge gently removed, a fresh portion of lint laid on, and the oiled-silk re-adjusted ; with a slight retentive bandaging if necessary ? The answer to such question is—As seldom as possible ; as frequently as cleanliness demands, and no oftener. When discharge is seen soaking through the dressing,

and beginning to drain away, renewal is had recourse to. For not only is the condition filthy, and as such affecting injuriously not only the patient but those around ; but, besides, the discharge, becoming subject to chemical change, grows irritant, and may induce degeneration in the sore, of an inflammatory type. There is then a necessity for change. But, until such necessity occur, let no change be made ; inasmuch as it cannot be effected, however delicately, without some injury being done to the tender surface by admission of atmospheric influence, as well as by rude mechanical contact. And by the oft repetition of this, again inflammatory degeneration may be induced. The "*nimia diligentia*" of surgery is fraught with manifold injury ; and is an error against which the junior practitioner should especially guard. In practical surgery, nothing, however simple in itself it may appear, should be done without a good and substantial reason for its use.

Another error, at least equally pernicious with too frequent dressing, is an affected nicety in making the change of application ; not only wiping away the redundancy of discharge, but insisting on perfect cleanness of the surface of the sore itself, till it look pretty and red ; washing, sponging, rubbing, irrigating ; thwarting Nature in one of her most beneficial acts ; taking away, clumsily and rudely, the best protection of the tender surface ; and invoking inflammatory accession, or tendency thereto, with consequent degeneration of the sore. At each dressing, gently wipe away pus from the surrounding integument, but do not interfere with that which covers and protects the granulations ; our dressing is subsidiary to this, and ought not to supersede it.

The means whereby the cleansing is effected are also a matter of some moment. Usually, it is by a sponge. But this is likely to prove injurious ; especially in the wards of an hospital. A sponge is a thing of some value, in the eyes of a patient or nurse ; and not to be lightly parted with. It is used not for one patient only, but for many, or all. It becomes soaked with discharge, of various kinds ; it is hastily and imperfectly cleansed, after each employment ; and, ere its daily course is run, can hardly fail to have been the means of conveying noxious matter to previously healthy sores ; inducing their degeneration, and perhaps exciting the serious complication of erysipelas. Instead of sponge therefore, especially in hospital practice, let fine tow, lint, or soft linen rag be used as the cleaning agent ; a thing of no value ; and which, consequently, may be burnt as soon as used, and have no opportunity of carrying contamination. And, generally speaking, the basin of cold water, usually in attendance during the dressing, may be well dispensed with too. Dry and gentle wiping of the surrounding skin, leaving the actual sore untouched, is all that is required. More is not only unnecessary, but tolerably certain to prove injurious ; it belongs to the "*nimia diligentia*."

But our attention must not be entirely engrossed with the part. In all kinds of ulcers, the state of the system must be constantly regarded. As this deteriorates, so will the sore ; and *vice versâ*. Indeed, a glance at the character of a sore is one of the best means for ascertaining the condition of the system ; the ulcer telling as truthfully as the tongue, pulse, or countenance. In the treatment of the simple healthy sore, it is plainly our duty, therefore, to rectify error in the system, if such exist,

with a view to the ulcer retaining its healthy character, until cicatrization is satisfactorily completed. Our attention will be specially directed towards the *primæ viæ*; clearing away noxious matter by purgatives, amending secretion by alteratives, increasing tone by appropriate remedies, and having due regard to the suitableness of regimen.

The tendency of the simple sore, unless when over-stimulated either by accidental injury or by malapraxis, is towards the second class, as already stated. And the prominent signs of change are to be found in the granulations, which become paler, taller, cedematous, less sensitive and vascular, overshooting the level of the surrounding skin; according to the common phrase, they are *exuberant* or *proud*. This coming change is to be met by a corresponding alteration in the treatment; the water-dressing being medicated, so that, by its stimulant quality, vigour may be duly maintained in the part, and degeneration prevented.

When the process of cicatrization is by any cause long delayed, however, deterioration often does occur, in spite of our best efforts to the contrary. And so long as exuberant granulations remain above the surrounding level, no good progress can be made; for unless the old skin and granulating surface be on the same level, or nearly so, new cuticular formation does not advance. The exuberance must be brought down; and for this purpose many remedies are in use. Escharotics may be employed; nitrate of silver, or sulphate of copper. The effect, however, is painful; not always easily limited, so as to save the pellicle already formed; and not unlikely to be followed by inflammatory excess; undoing the granulating texture, by ulceration established afresh. Dry pressure is in all respects preferable; less painful; with ordinary care, easily limited to the part desired; and not likely to exceed in its effect. A portion of lint or charpie is neatly laid over the sprouting granulations; carefully avoiding the surrounding pellicle of new skin—therefore always rather too small than too large; and, if we wish to have the tender margins especially protected, we may cover them with thin pledgets of fine lint spread with simple ointment—over all a plate of sheet-lead moulded to the general surface being laid, so as to afford equable support. This dressing is retained by a few turns of a bandage; not very tightly applied however; for the intention is merely to occasion absorption of the granulations, with a sthenic augmentation of vascular function around. It is plain, therefore, that care is necessary not only in adapting the compress, but also in applying the retentive bandage; lest either or both induce a greater result than is suited to the object in view. A few hours' use of a gentle compress will sometimes suffice. In all cases, the dressing should be early undone; that it may be desisted from, so soon as the desired result has been obtained. Then—granulations and skin being once more on a level—the simple protective dressing is resumed; and cicatrization proceeds afresh. In certain situations, as the neck, the application of pressure may be inconvenient or altogether impracticable; and, under such circumstances, an escharotic is to be used gently.

2. The Weak Sore.

This is usually the result of the preceding; when, from any cause, local

or constitutional, cicatrization has been delayed, and debility has usurped the place of sufficient repair. The granulations are cedematous, larger, and less numerous than in the healthy sore ; much paler, of a faint pink, or yellowish hue ; taller, not of a decidedly conical form, and bulbous rather than pointed at the apex ; less firm, as if dimly translucent ; little sensitive, bearing to be rubbed almost with impunity ; less vascular, emitting blood but sparingly unless rudely handled ; and the blood which does flow has often more of the venous than of the arterial character. The discharge is pale and thin, serum greatly predominating over the solid particles ; there is but little fibrinous product, whether going to waste as pus, or going to repair as granulations. The general character of the surface is pale, flabby, and elevated above the surrounding integument. This latter is often the seat of passive congestion ; and, sometimes, of a serous effusion following thereon. Consequently, it is of a blue or livid tint, soft, and somewhat swollen, though still below the level of the granulations. Often its free margin is overlaid by a bending over of the tall granulating mass ; and the surface of the latter not unfrequently parts with the granulated character ; becoming smooth and villous in its appearance.



Fig. 25.

When the sore has been the seat of frequent change ; ulcerating one day, granulating well the second, and weakly on the third—the granulations coming and going, as it were—it is not uncommon for these variations to be succeeded by a permanently weak character of the ulcerated surface ; and its integumental margins, having lost their support by the previous accessions of ulceration, are more or less inverted, as well as unusually dark from livid discoloration. This undermining, with consequent inversion of the margin, is rather to be regarded as an accidental than as one of the ordinary characteristics of the weak sore. Sometimes, the undermining is extensive at one or more points ; matter accumulates there, unless when removed by pressure ; and a probe passes readily into the cavity, which is marked externally by swelling and blueness of the integument.

All, in short, evinces a want of sthenic function ; and this may either depend upon local circumstances, as already shewn, or be but one indication among others of a feeble system. No ulcer of large extent can escape degeneration into this form ; it is the inevitable result of protracted cicatrization. A sore situated on the lower extremities—far from the centre of circulation, its venous return often if not habitually opposed, and all circumstances very favourable to passive congestion—is extremely prone to become weak. And, not unfrequently, such degeneration would seem to be connected with atmospheric influence. One day, the majority of ulcers in an hospital, or ward, may shew a healthy character ; on the next they may all be weak, or otherwise deteriorated, with no cause assignable, excepting perhaps the occurrence of a sudden, marked, and unfavourable change of weather. Repeated ulceration of the same part is a

Fig. 25. The weak sore, of elevated surface. High granulations overlapping.

plain indication of debility there ; and it need not surprise us to find that sores so produced invariably tend towards the weak character. Also, whenever the breach of surface has been originally caused by injury which entails debility of the surrounding parts, that debility is certain soon to shew itself in the sore ; as after bruise and burn.

Treatment.—Prevention being better than cure, it will be our object to prevent decline from the healthy condition, if circumstances place this within our power. The granulations getting pale, tall, and changed both in form and number, we abandon the simple water-dressing, and have recourse to stimulants ; gentle at first, lest over-excitement be induced. The piece of lint, instead of being steeped in plain tepid water, is saturated with a solution of a stimulant nature, and reapplied in the ordinary way. Sulphate of zinc, nitrate of silver, sulphate of copper, creasote, chloruret of soda, are some of the excitants more commonly employed. Of these, that which enjoys most general favour, and perhaps with justice, is the sulphate of zinc—in the form of lotion. This may consist of twelve grains of the sulphate of zinc, with two drachms of the compound spirit of lavender, and half a drachm of the spirit of rosemary, mixed with six ounces of water ; but, of course, the flavouring ingredients may be varied in their proportions, to suit convenience or fancy. If the lotion smart much on its first application, it is to be diluted with tepid water ; gradually diminishing the amount of this, in proportion as increase of stimulus is required. It is well, however, that we have a number of such remedies at our disposal. For any one of them, used for a considerable period, loses its effect ; and it is better, under such circumstances, to shift from one kind of lotion to another, than to increase the strength of the one originally employed. At the same time, moderate bandaging is applied ; by its mechanical support favouring venous return and a normal state of general circulation in the part ; affording also the salutary stimulus of uniform gentle pressure ; and preventing the occurrence of passive congestion—a sure forerunner, if not an attendant on debility.

The fulfilment of such indications, by bandaging, carefully employed, is also plainly applicable to the treatment of the first class of sore, when it has been long open, and threatens in consequence to pass into the weak state. A bandage, with medicated water-dressing, and due attention to the system, will in many cases succeed in maintaining the healing characters of the first class ; thereby much abbreviating the process of healing.

Malgaigne has proposed a new method of stimulating a weak sore. A piece of iron, such as a cautery, is heated to a white heat, and then held at a comfortable distance from the sore ; gradually approximating it, as the patient's sensations will bear. I have sometimes found this produce a rapid and satisfactory amendment.

Ointments were at one time much in vogue in the treatment of ulcers ; but are now almost entirely superseded by the water-dressing, simple or medicated, which possesses all the good qualities of the other, without any of the actual and possible disadvantages.

Should the judicious use of the stimulant lotions fail to repress the tendency to exuberance or granulation, they are to be for a short time superseded by the compress of dry lint and sheet-lead ; and when the level has been thus

restored—though often it may be well to continue the pressure, until the granulating surface is a little lower than the surrounding skin—their use is resumed.

But local support is not alone sufficient. The general system requires our aid as well. Secretion and excretion having been found in order, or having been duly restored, nutritious regimen is enjoined ; given with a freedom proportioned to the power of digestion. And all sources of depressing influence are studiously avoided.

3. *The Scrofulous Sore.*

This class of ulcer is weak, almost from the first. For it is only one indication, among others, of a system not only decidedly weak, but of such debility as establishes a decidedly vicious or cachectic state—that of scrofula. Such sores seldom occur singly. They are gregarious ; at first distinct from each other, but ultimately becoming more or less confluent. The most frequent sites are the neck, shoulders, arms, hips, lower limbs—especially in the neighbourhood of the articulations. The sores extend more in surface than in depth ; yet their origin is not in the skin, as most other ulcers are, but in the areolar tissue beneath. Commencement is made there by tubercular formation ; causing induration and enlargement, at first painless. Then a low inflammatory process sets in ; and the consequences are pain in the infiltrated part, increase of swelling, and redness of the superimposed integument, with the other ordinary signs of chronic inflammatory progress. Imperfect suppuration takes place ; and the swelling softens, and pits on pressure. By and by fluctuation is felt ; and the fluid is seen through the skin, very much attenuated ; but there is no regular pointing. Almost the whole of the integument over the suppurated and infiltrated part becomes thin, blue, and translucent ; it gives way, partly by sloughing, partly by ulceration ; and through the ragged, irregular aperture thus formed, portions of slough, mingled with thin pus and broken-down tubercular matter, are discharged.

For some time, no effort is made towards repair ; on the contrary, the thinned and blue integument still further ulcerates, and the broken-down tissue beneath oozes away in the discharge. The surface has no granulations, and is of a dirty grey hue ; surrounded by thin discoloured skin, undermined, inverted, and floating loosely on the subjacent parts. After a time, some parts of the altered tissue having been cleared away, by disintegration or sloughing, there granulations begin to appear. But they are of the weak kind ; tall, pale, and exuberant. A probe, used even with much gentleness, passes readily through granulations into the boggy texture beneath ; causing little if any pain, and but slight effusion of blood. Or, following a superficial course, it finds integument undermined, and a ready communication so established from sore to sore. Around the cluster, there is usually a considerable amount of the ordinary in-



Fig. 26.

Fig. 26. The scrofulous sore on the leg. Of the gregarious kind.

flammatory products—mainly serous. And this greatly increases the amount of general swelling, while it no doubt obstructs still further all salutary effort towards repair.

The system, originally in a bad state, is worse now ; sympathising with the local disorder ; and usually evincing, more or less intensely, the ordinary signs of constitutional irritation.

Such sores, if left to themselves, sometimes skin over, at least in part ; imperfect clearance of the tuberculated texture having probably been effected, by either ulceration or sloughing, or by both. But such cicatrix is very unstable, and certain to be undone at no distant period ; disclosing a state of matters beneath not in the slightest degree amended. It is blue, soft, spongy, and elevated ; whereas the true cicatrix is white, firm, and depressed. It is but as “the green mantle of the standing pool,” which only for a time obscures the filthiness beneath.

Treatment.—It need hardly be said that the more important part of this is constitutional ; attacking not one symptom of the disease, the sore ; but the disease itself, the scrofula. The nature of that treatment need not be here detailed. Suffice it to say, that it must be steadily and patiently persevered in, not only during cure of the local affection, but long after ; otherwise immunity from speedy relapse can never be expected. Indeed, the most difficult part of the treatment will be found to consist in preventing return of the sores, but lately healed ; resumption of the erect posture, exposure to cold, a blow, starvation, an excess in diet, too often sufficing for early reproduction.

The local management requires to be energetic, and at first severe.

Medicated lotions, ointments, poultices, prove wholly unavailing. There is an unsound foundation for the reparative process ; and that must be cleared away. This may sometimes be effected by the repeated application of blisters to the whole extent of the surface implicated. Or potassa fusa, in solid substance, is inserted boldly into the infiltrated tissue. If the skin have not already given way, it will yield readily before this. And then the caustic is freely moved in various directions ; so as to destroy not only the areolar tissue where tuberculated, but also the integuments where thinned, blue, undermined, and obviously incapable of recovery. The work of destruction is completed at once—under chloroform ; else it is very painful. But it is not necessary to convert all into an immediate eschar. This were to be unnecessarily severe, and to sacrifice an unwarrantable amount of primary texture. A portion of this is recoverable, under the sthenic inflammatory process which usually follows cauterization of the parts hopelessly diseased. A little experience is needful, therefore, to determine the limits of the escharotic's thrust.

The surrounding parts, during the operation, are protected by oil or vinegar ; and afterwards, this is freely applied to the cauterized part also, in order to assuage the pain, and prevent unnecessary extension of the escharotic effect.

Dark, bloody discharge oozes out during the application ; containing a considerable quantity of the escharotic in solution ; and this is carefully and constantly wiped away from the integument on which it comes. After such discharge has ceased, the whole part is covered with a poultice. And this dressing is continued until the slough has separated ; disclosing

a healthy granulating surface beneath. Then water-dressing is assumed and the local management afterwards conducted as for the first class of sore ; into which the original affection has in truth been happily converted. Objections have been made to this mode of treatment, as being cruel, destructive, and unnecessary. The first objection is met by the chloroform during the operation, and vinegar afterwards ; the second is admitted, as regards irrecoverable tissue—surely a commendable result ; the third is humbly denied. It is a procedure most unnecessary in the *cachectic* sore, which the *scrofulous* sore closely resembles, and with which it is very commonly confounded. In the case of the latter, if not absolutely necessary, it is at least highly expedient, as rendering the cure at once more speedy and more certain.

On separation of the slough, should the appearance of the subjacent part not be altogether satisfactory, the potass may be re-applied, to such an extent as may be deemed necessary.

After cicatrization, it is to maintainance of general treatment that we must look for prevention of relapse ; along with uniform support afforded to the part, more especially when this is in the lower limb. Bandaging is under such circumstances a most valuable means of prophylaxis ; or, what is better, an elastic stocking, tight enough to support the limb, yet permitting freedom of muscular play and of venous circulation. And be it remembered that all cicatrices, more especially when extensive, and the result of sores defective in reparative power, require much protecting care ; being, by reason of recent and imperfect organization, very liable to be undone by reaccession of ulceration.

4. *The Cachectic Sore.*

This, in many of its characters, resembles the preceding ; but is not connected with subcutaneous tubercular formation, or with scrofulous cachexy. The constitutional evil is of another kind ; mercurial, syphilitic, or both.

The sore is most frequently found in the limbs ; especially the lower ; and the patients are generally adults. There is a plurality of openings ; and subcutaneous communication may or may not exist ; usually it does not—the intra-ulcerous parts being, indeed, preternaturally dense and firm. The ulcerous surfaces are of the weak character ; but may be, incidentally, irritable or inflamed. The discharge is thin and serous ; the surrounding skin is dusky, and slightly swoln ; and often, in the near neighbourhood, there are cicatrices, perhaps extensive, where similar sores had formerly been. Pain is considerable ; the limb is wasted and weak ; and the countenance wears the well-known expression of that constitutional evil which is the root and origin of the local malady.

Treatment is simple ; and mainly constitutional. The iodide of potas-

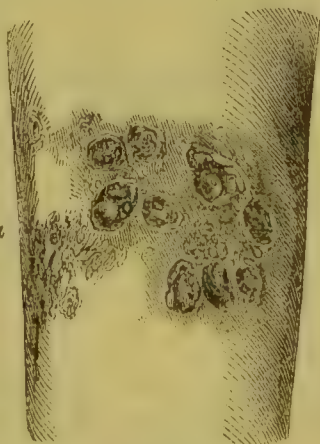


Fig. 27.

Fig. 27. The cachectic sore. At *a*, cicatrices of former ulceration seen.

sium is given in full and sustained doses ; and ordinary stimulant treatment is applied to the weak sores. Under the internal remedy, rapid amendment and cure often take place. But, once healed, the difficulty remains, as in the scrofulous sore—to prevent relapse. And to meet this indication, constitutional management is again paramount.

The principal points of difference between this and the preceding class of sore, are—the absence of tubercular formation ; the initiatory inflammatory process a simple one ; the originating presence of the mercurial, syphilitic, or mercurio-syphilitic cachexy, instead of the strumous ; the comparative soundness of the areolar tissue ; and the absence of necessity for escharotic or otherwise active local treatment.

5. *The Indolent Sore.*

This, perhaps the most common of all ulcers, is most frequently found in the lower extremities, and at a somewhat advanced age. It is invariably of secondary formation ; the condition of confirmed deficiency in reparative power having supervened on a state of matters widely different. The sore may have been at first healthy, then inflamed, perhaps thereafter irritable, then weak, and ultimately indolent ; merely in consequence of cicatrization having been often opposed and long delayed, by the situation or size of the sore, and by the accidents to which it has been exposed. A weak system may coexist—having had some share in inducing the local apathy.

From what has just been said, it can be readily understood how such sores should be most frequently found in the legs of labouring men ; so frequently indeed as almost to render the indolent sore peculiar to that important class.

The surface is excavated, smooth, glossy, pale, sometimes altogether void of granulation, sometimes sparsely studded by a feeble attempt at such formation. The discharge is thin, serous, and very foetid ; containing but little pus. The surrounding integument is swollen, condensed, and discoloured by passive congestion. That which constitutes the margin of the sore is much elevated above the raw surface ; round, dense, white, callous. And in truth this is the most striking characteristic of the sore ; which not unfrequently looks like a piece of pale mucous membrane set in a dense and high ring of cartilage. It need hardly be said that such margins are not undermined, and neither everted nor inverted ; but raised abruptly, a firm solid structure ; the result of repeated accessions of



Fig. 28.

the inflammatory process, of a low grade and chronic character. Both sore and margins are comparatively insensible.

But, usually, the sore does not present the characters just enumerated, when first brought under our notice. So long as it is merely an indolent

Fig. 28. The indolent sore, on the ankle. Usually the cutaneous margins are less irregular than in this instance—more smooth and rounded.

ulcer, the patient suffers little pain or other uneasiness ; and continues his wonted avocations. But he receives a blow on the part ; or is exposed to wet and cold, or other exciting cause of the inflammatory process. This is induced, in and around the sore ; he can work no longer ; the erect position, even, is difficult ; and he then applies for relief. Under such circumstances, the ordinary characters of the indolent class are seen, as it were, through an inflammatory medium. The surrounding skin is red, more swollen, painful ; and even the callous margins are discoloured. The raw surface is still low, and void of granulation, but red and softening. The discharge is still thin ; but bloody, and mixed with more or less disintegrated texture ; for ulceration is soon re-established. By and by, the part, being low in power, is overborne ; the margins, as well as the surface of the sore, become converted into a slough ; and, as such, are gradually detached. On separation of these, we expect to find a healthy surface beneath ; so soon as the inflammatory and ulcerative processes shall have subsided.

The Mucous Sore, of some authors, is usually a variety of the indolent class ; in which the raw surface, by reason of long persistence, has been thoroughly converted into a resemblance of mucous tissue ; pale-red, smooth, and villous ; shining, as if varnished ; with a limpid, quasi-mucous discharge. Or a weak sore, without assuming much of the indolent character, may degenerate into a mucous-looking surface ; as after wound.

Treatment of the Indolent Sore.—As just stated, the part is usually presented in an inflamed state. The patient is put to bed, and a poultice is applied to the sore and its vicinity. The tongue will be found heavily coated ; and other plain indications of derangement in the primæ viæ will not be wanting. An active purge, repeated if necessary, is therefore highly expedient. Low diet is enjoined ; and if this, with action on the bowels, be not quite equal to allay the inflammatory fever, which is likely to be more or less developed, aconite or antimony may be also given. Thus, in a day or two, a cleansing of the sore is obtained ; that is, the slough, having become completed, separates by ulceration ; the inflammatory process subsides from the suppurative and ulcerative grades, and remains in a more subdued form, favourable to plastic effort. Consequently, on detachment of the slough, a healthy surface is usually found beneath ; demanding the kind of treatment suitable to the first class of sore.

When the sore is presented in the simply indolent state, two modes of treatment are in our option. *First*, we may imitate the process whereby Nature rids the part of its incubus : by induction of the inflammatory process in the margins of the sore and thickened textures by which they are environed. This converts the callous indolent sore into an inflamed ulcer, followed by removal of the old plastic products, and giving the granulating condition on subsidence of the inflammatory. For this purpose, a blister is probably the most convenient stimulus. Usually, it is applied so as to act over a considerable extent of surface ; and, after the requisite amount of inflammatory disturbance has been induced, the treatment is the same as that already advised under similar circumstances of

spontaneous origin. Sometimes reapplication of the blister, from time to time, may be required, to prevent the return of the sore to the callous condition.

Second.—By continued pressure the surrounding elevation is undone, and the varnished surface of the sore changed into a granulating one. The first part of the manipulations is to support the whole limb, below the ulcerated point, by moderate and uniform bandaging. If this be neglected, congestion must take place; and more serious consequences are not unlikely to follow. Then a strip of common adhesive plaster, about one inch in breadth, is applied with tolerable tightness over the lower part of the sore; crossing the ends over this, the centre of the strip having been applied to the opposite part of the limb. Plaster after plaster is thus adjusted, until we have invested not only the whole ulcerated surface, but also a little of the unbroken skin both below and above. And when



Fig. 29.

the sore is large and its discharge profuse, a slit may be made in each strap, where it crosses over the ulcer, in order to prevent purulent accumulation. The bandaging, which had stopped to permit application of the plaster, is then continued; covering the whole limb, from the very distal extremity, to about a handbreadth above the seat of ulcer. The limb is then placed in an elevated position; and, for some hours, the recumbent posture is strictly maintained. A feeling of constriction, sometimes

amounting to actual pain, is usually complained of, but seldom lasts long; and still more rarely does it, by persistence, render an undoing of the dressing necessary. It is met by rest, and elevation of the part; or should these fail, affusion of cold water will suffice to restore comfort.

After two days—not earlier, unless symptoms of over-stimulation have manifested themselves—the bandage is undone. A grooved director is insinuated beneath the plaster, at the point opposite to the ulcer; and on this the strap is cut. The dressing is then gently removed; and, according to the change which has been effected in the sore, is the same dressing repeated, or another substituted more suited to the characters which the sore now presents. Often, after but two dressings by strap, the ulcer is found to have assumed the characters of the healing sore.

By the pressure on the callous margins, absorption is instituted there—partly interstitial, partly continuous; and thus they are gradually brought down from their undue exaltation of level. By the same agent, acting on the villous surface, this is stimulated to granulation. For pressure which causes absorption in the brawny integument surrounding the sore, stimulates the surface to the induction of an inflammatory pro-

Fig. 29. Strapping of the indolent ulcer shewn.

cess, attended by plastic results. Thus granulation succeeds ; and the raw surface becoming continuous with the surrounding integument, which has regained its normal thickness and pliancy, the conditions requisite for cicatrization are gradually approached.

The stimulus continues to act on both skin and sore ; causing absorption in the one, and maintaining vigour in the other. As formerly explained, pressure, in a slight dose, excites absorption chiefly ; in a greater it arouses the inflammatory process of a sthenic kind and moderate degree ; while a still larger dose reaches the inflammatory acme of suppuration and ulceration. Here the same dose is applied to both margins and sore ; but the latter is less tolerant than the former ; and in regard to the latter the same pressure is practically equal to a higher dose than that which is operating on the margin.

Besides, the mechanical effect of the circular band is to draw together the sound parts ; and thus greatly to favour not the least important portion of the cicatrizing process—namely, centripetal movement of the original tissues.

Sometimes, when the edges are very high, and the sore deep and small, the plaster reaches only the margins at first ; the raw surface escaping by their interposition. A certain amount of salutary stimulus is nevertheless conveyed to the latter ; and, on subsidence of the skin, pressure comes to act on both in the usual manner. To expedite matters, it may be well sometimes to dissect off the hardened cuticle, painlessly, as one would a corn.

All risk of strangulation of the limb may be prevented by a very simple proceeding ; making a section of the mass of plaster, after it has firmed on the part, on a grooved director introduced at the point opposite to the sore. While this is sufficient to relieve constriction, and to moderate pressure, the beneficial effects of the latter are not foregone ; and besides, resilience of the plaster, to the opposite point from that which is cut, plainly augments the important centripetal action of the integument and subcutaneous areolar tissue around the sore. This modification, therefore, apparently of a trifling nature, may be in truth an important addition to the manipulation ; not always necessary ; but useful in those cases in which intolerance of the ordinary pressure may in some degree exist. The strap, having been firmly applied, is allowed a few minutes to consolidate, and tightly to embrace the limb at all points ; and then the section is made.

Another advantage of this second mode of treatment is, that although more progress is likely to be made in the recumbent posture, yet it is not essential that this should be uniformly maintained. For a few hours after adjustment of the dressing, rest is indispensable ; but afterwards the erect posture may be resumed, and wonted avocations therewith—a point often of much consequence to the patient. Such resumption may delay the cure, but will not always prevent it.

Throughout the cure, the system is duly attended to. The diet is generous ; and it may be that tonics, and even stimuli, become expedient. For little good can be expected to follow the most skilful treatment of the part, unless the general frame be provided with sufficient power to maintain the work of repair. Among other internal stimuli, turpentine has been found very useful. And, in the opinion of some, small doses of

opium—half a grain night and morning—are of service, in maintaining energy of the capillary circulation, more especially when the patient is advanced in years.

After cicatrization, local support, by bandaging or an elastic stocking, is not to be omitted; otherwise relapse is but too probable. A small circular aperture appears near the centre of the cicatrix, as if made by a pin's point; this rapidly enlarges; and the sore may assume the characters either again of the indolent, or of some other variety.

6. *The Irritable Sore.*

This sore is almost invariably superficial; not penetrating more deeply than the true skin, which texture may indeed be said to be its peculiar site—a circumstance which may in part account for its great sensibility. The surface is unequal; deeper at some points than others. It is void of true granulation—though sometimes undulating on the surface, like a bramble-berry; and either of an angry, dark-red, fleshy hue, or covered with a greyish film of tenacious fibrinous product. Sometimes this covering only partially invests the surface; which then shews both the red and grey appearances. The edges are thin, serrated, and everted; sometimes studded with brightly florid points, as if of arterial blood. The surrounding skin is slightly swoln, and also of a dull red colour; being in a state of passive congestion; or undergoing an inflammatory process of a low grade.



Fig. 30.

Discharge is thin, acrid, bloody; often mingled with solid matter—either recently formed, or the result of disintegration in the primary textures. Pain is constant; always considerable, often excessive. The slightest interference with the acutely sensitive surface is followed by a feeling of intense burning, and by a copious flow of blood, usually of a dark grumous character; as if the injury were resented, instead of being merely acknowledged, as in the healthy sore. Generally, an irritable state of system precedes and accompanies this state of the part; and even when no such predisposition exists, that morbid condition of system is, sooner or later, tolerably certain to occur.

Treatment.—This is partly, and often mainly, constitutional. The predisposing, if not the exciting cause, is in many cases found in the system; and must be opposed by the suitable remedies. With this view, the primæ viæ and general secretions will especially claim our attentive regard. Often an improvement, both immediate and marked, follows the administration of a smart mercurial purge. Local management consists in rest, elevation, and relaxation of the part; and such applications as are considered to be most advisable in cases of irritation. Of these, none are so generally useful as the nitrate of silver; applied lightly to the raw surface; but with some intensity to the margins, so as to produce a slightly escharotic effect there, and bring them into a form more suitable for the commencement of cicatrization; and pencilled, still slightly,

Fig. 30. The irritable ulcer; dark; almost passing into the phagedænic.

over the surrounding skin, where swollen and discoloured—so as merely to blacken this, and obtain the sedative and purely antiphlogistic effect. A temporary increase of pain usually follows, in the sore ; but soon passes away, on the application of a soft light poultice, or hot-water dressing. And this epithem is continued until re-application of the nitrate ; which may be daily, or only on each alternate day, according to the effect produced.

Under this treatment, amendment is often rapid and satisfactory ; pain diminishing, and soon ceasing to be inordinate ; the margins losing their irritable characteristics ; and the raw surface beginning to be studded with healthy granulations. Then, ordinary simple treatment is assumed. But success is not invariable. Pain may be permanently increased by the application ; and then the sore either becomes more and more irritable, or threatens to pass into the inflamed. In such circumstances, means more simply sedative must be applied ; pencilling by nitrate of silver being still continued, however, to the surrounding integument. An aqueous solution of opium may be used, five grains to the ounce ; or conium, hyoscyamus, belladonna, hydrocyanic acid, or aconite, cautiously ; and sometimes good effects are produced by a weak nitric-acid lotion—from two to five drops to the ounce of distilled water.

When irritable sores are but part of the *sequelæ* of syphilitic infection of the system, the constitutional treatment will of course be such as is suitable for the eradication of that evil. When they are secondary to cutaneous eruption, but not of a specific kind, a weak solution of arsenic is often very beneficial as a local application ; and, in such cases, it is well to combine the internal with the local use of this remedy.

On the whole, as already stated, the most trustworthy and generally applicable local remedy is the nitrate of silver. Used not oftener than daily ; and, usually, but once in the forty-eight hours. Applied with great lightness to the raw surface and surrounding skin so as only to produce its slightest effect—the very opposite of escharotic—sedative, anodyne, and protective by the formation of an investing pellicle on the sore. Pressed firmly only on the margins ; and they too but tenderly dealt with, so soon as they have undergone a favourable change.

But, whatever be the local management, let it never be forgotten that an indispensable, and often by far the most important part of the treatment, consists in remedies directed to the system. If this be neglected, no local application will be of any permanent avail. The ulcer in most cases has sprung from, and is maintained by, an evil state of constitution, and only by eradication of that origin and maintenance can it be removed.

7. *The Inflamed Sore.*

This presents the ordinary characters of advancing ulceration, with accompanying inflammatory progress ; and, as can be readily understood, is the most common original form of ulcer. Very often, however, it is of secondary occurrence ; for over-stimulation is not unlikely to happen to ulcers of a healthy as well as of a sluggish kind. The raw surface is steadily disintegrating ; and, instead of contracting, enlarges ; shewing no granulations, but a soft, raw, pulpy substance ; and emitting

a profuse ill-formed pus, mingled with the ulcerative *debris*. The margins are swollen, red, hot, tense, and painful; and so is the surrounding integument. The erect posture and motion increase the pain; the system may be more or less involved in febrile disturbance; and the *primæ viæ* are usually detected in marked disorder. Not unfrequently, the inflammatory process running high, while local power is weak, sloughing takes place, more or less extensively; as already noticed in regard to the inflammatory condition supervening on the Indolent variety of sore.

Treatment consists in moderate antiphlogistics. Rest, relaxation, elevated position, fomentation, poultice, hot-water dressing, antiphlogistic regimen, purgatives, aconite, or antimonial. Sometimes it is necessary to draw blood locally; and this may be done by leeches or punctures. The former are sometimes placed on the sore itself, with good effect. Punctures are preferable, however, in the integument. For leeches there are apt, by their own irritation, to induce spreading of the inflammatory process, of an erysipelatous kind; or the bites may themselves ulcerate, and so extend the original disease. Let not antiphlogistics, however, even when moderate, be continued one moment longer than is absolutely necessary; otherwise degeneration into the weak sore is speedy and certain.

8. *The Sloughing Sore.*

This differs from the sloughing state which not unfrequently affects the simply inflamed sore, in being not casual and temporary, but an inherent characteristic of the disease. It usually begins with the formation of a slough; and continues to enlarge, by repetition of the same process. Such morbid change may be in itself not great, and in a sound texture would probably lead to no destructive result; but in a worn frame and weak part, vital power is quickly overborne; and almost the first indication of the inflammatory onset may be the supersedence of vital by chemical change. Thus the inflammatory process instituted in the sexual organs of ill-clothed, ill-fed, intemperate prostitutes, living in the densest and filthiest parts of dense and filthy cities, is very apt to produce this kind of sore. Here local and general debility exist, before application of the exciting cause. But the relation may be reversed. The cause may be capable of exerting such a depressing influence on both system and part, rapidly, that the inflammatory process which it excites very speedily terminates in gangrene; as happens in inoculation of certain poisons—that of venomous snakes, for example, or of diseased animals.

Or the inflammatory process may itself induce a change in the part affected; inimical to reparation or controlling power, and favourable to the predominance of disease. Thus, a sore on the penis may be of a simply acute nature; paraphymosis ensues, in consequence of the surrounding inflammatory swelling; change of relative position is neglected; consolidation takes place; and then attempts at reduction are unsuccessful. The constriction is neither so great nor so complete, as to produce sphacelus of the whole glans; but it is sufficient to establish slough after

slough on the breach of surface. And this is an example of what may be termed the secondary sloughing sore ; not commencing with a slough ; but an ulcer, passing into that condition, and remaining so degenerated.

The originating slough is sometimes dry, sometimes moist ; according to the rapidity with which the destructive process has advanced. Usually, great humidity is one of the most characteristic features of the sore. When dry, the case may be termed a chronic form of the disease ; by far the less frequent in occurrence. Sometimes, after a dry commencement has been made, rapid transition takes place into the humid form, accompanied with great pain ; the discharge commencing when the first slough begins to separate, and soon becoming profuse. Whatever may have been the previous state of system, there is soon much constitutional irritation ; and, at the same time, the primæ viæ—by loaded tongue, foetid breath, etc.—generally indicate very prominent disorder there. Not unfrequently—as in the malignant pustule—a vesicular or pustular condition of the surface briefly precedes actual death of the part.



Fig. 31.

A superficial slough having fairly formed, it begins to be detached. Its edges loosen, and expose the subjacent parts ; but these, instead of shewing the red fleshy granulations of repair, or even the angry aspect of advancing ulceration, disclose but a new formation of slough, soft and tawny. And thus gangrene upon gangrene may succeed—in strata, as it were—until the part has been frightfully mutilated, and the system brought into most alarming disorder. The surface is generally of an ashy hue ; sometimes inflated by extricated gases ; sometimes darkened by commixture with a grumous bloody serum. The discharge is thin, foetid, sanious ; usually very profuse, giving the characteristic humidity ; and mingled with putrid solids, partially dissolved. Not unfrequently, hemorrhage takes place ; profuse ; arterial or venous, more frequently the former ; the sloughing having opened a vessel of considerable size and activity. The result of this bleeding is sometimes beneficial, sometimes hazardous : the former, if it affect only the part—critically resolving the action ; the latter, if it affect not only the part but the system—depressing still further the powers of life, which are already too low. Fatal results, from this cause, have not been unfrequent.

There is every reason to believe that this form of malady, when occurring in different members of a community, or in the wards of an hospital, is contagious ; and that the secretion from a sore of this kind, applied to a healthy ulcer, or perhaps even to an unbroken portion of skin, may induce a state similar to the original.

9. *The Phagedænic Sore.*

This is a spreading ulcer ; destruction advancing more determinedly than in simple ulceration, however acute ; but still by molecules ; not by

Fig. 31. The sloughing sore, as affecting the penis. The prepuce almost gone ; the glans going.—ACTON.

masses, as in sloughing. It results from a somewhat similar conjunction of circumstances with the preceding ; local disturbance exceeding local power, and usually attended with debility as well as irritability of the system. Two forms occur ; the acute and chronic.

The acute is usually a sore of irregular form ; with margins abrupt and somewhat ragged. And these, as well as the integument to some distance around, are red and slightly swoln. There is a sensation of sharp burning heat in the part. The raw surface is of a brownish hue, or ash grey colour, totally void of anything like granulations, uneven in depth, and in many places presenting the appearance as if gnawed by the teeth of a small animal. The system suffers severely ; and the form of its disorder is of the irritative type.



Fig. 32.

The chronic variety is less painful, less inflamed, less rapid, darker in hue, with the gnawed appearance usually more distinct ; commonly surrounded by considerable thickening and hardness of the tissues, and often spreading at one aspect, while slowly cicatrizing at the opposite. If several sores exist, all usually extend in the same direction. Withal, the constitutional disturbance is less severe.

10. *The Sloughing-Phagedæna.*

The acute phagedænic sore seldom persists in a distinct form. Much more frequently, it is associated with the sloughing ; constituting *Sloughing-phagedæna*. Commencement may be by either. If phagedæna have preceded, the sore becomes lighter in colour, with margins less distinct, temporary diminution of discharge, and perhaps a lull in the pain. A thin slough forms. This begins to separate ; discharge again becomes profuse ; and, on separation having somewhat advanced, either a second slough is seen being formed, or the part is found again under the influence of phagedæna. Sometimes the alternation of slough and ulcer is tolerably regular ; in other cases, one or other form of destruction may have the predominance.

Constitutional disturbance is at least equally severe as in either the sloughing sore or acute phagedæna, uncombined. Indeed, very frequently both part and system suffer more in the combined form, than in either singly. The combined is less frequently original than either of the separate forms.

Familiar examples of the sloughing ulcer are—the Malignant pustule, and the sloughing sore of the penis ; of the phagedænic, lupus of the face, and the phagedænic form of venereal disease ; of the sloughing-phagedæna, Hospital gangrene or sore, and Cancerum oris. In all these varieties, but more especially the last, discharge is remarkably foetid, as well as profuse. And the foetor is so strikingly peculiar as to constitute one of the most prominent characters of the disease ; poisoning thoroughly the atmosphere of even a large apartment, and felt oppressive at a considerable distance.

Treatment.—The treatment of these three classes being in most

Fig. 32. Acute phagedæna, burrowing beneath the integuments of the penis.—ACRON.

respects identical, has been reserved till now. It is both constitutional and local. The *primæ viæ* almost invariably shewing signs of oppression, a purgative, not over active, is exhibited. And some antimonial may be at the same time given; should there seem any effort towards a sthenic form, in the constitutional disorder. If so, it will only be at the commencement; for very soon Irritation is the decided type. When the tongue begins to clean, and the patient looks lightened by the evacuation, then the treatment peculiar to constitutional irritation should come into play. A very suitable remedy, under such circumstances, is Dover's powder; in doses of ten grains, or thereby, given three times a day. It relieves the secretions, assuages local pain and general irritation, brings down the pulse, gives sleep, and obviously exerts a most beneficial influence on the local disease. And should this, by its persistence, demand repetition of painful remedies, it is well to give an additional dose of the powder at each such repetition. At the same time the use of iron internally is usually of great value; in the form of either the sesquichloride or the tartarised salt—in full and sustained doses. Atmospheric influence should also be attended to. In many cases—more especially when this form of sore is of secondary accession—this would seem to be the predisposing, if not the exciting cause of the disease. And whenever circumstances give rise to such suspicion, the patient ought of course to be carefully excluded, as much as possible, from the operation of the untoward agency. Diet should be good, yet non-stimulant; and in the first instance, at all events, restriction to the farinacea will be expedient.

As to local management, surgeons are not quite agreed. One party advocate the most lenient measures—poulticing, rest, and expectancy; while another are in favour of severe and active remedies—escharotics—at the outset; in order to cut short the disease, and—along with suitable constitutional treatment—to change the character of the sore into the healing type. Among the latter I would have myself enrolled; and simply because experience of both gives, to my perception, a decided superiority to the energetic over the expectant system. One reason why some have lost faith in active remedies, I believe to be, that these have not been efficiently applied. Great humidity has been already stated to be a prominent characteristic of the majority of such sores. An escharotic, applied to the parts unprepared, proves almost inert; for it is dissolved by the fluids, and passes off after having but grazed the solids. The first and most essential part of the manipulation is, to dry the surface and parts around thoroughly; by tow or lint, gently yet firmly applied. At the same time, loose sloughs are taken away, and the thickness of adherent dead parts is diminished, by scissors. Thus, and thus only, is the sore prepared to be duly affected by escharotics.

Of these, two are most in favour; nitric acid, undiluted; and the fluid pernitrate of mercury. The former seems the more adapted for general use; and is certainly preferable for the first application; being equally effectual in forming an immediate and sufficient eschar, and followed by considerably less protracted pain. A flat piece of wood, or a director wrapped round at the extremity with lint, is soaked in the acid; and then pressed firmly on every part of the affected surface, as well as on the yet living margins. And the application is continued, until all

has been converted into eschar ; protecting the surrounding integument by carefully wiping up the fluid product. The part is then covered by a soft warm poultice ; and this application is continued until the eschar begins to separate, when it may be conveniently superseded by warm-water dressing. Not unfrequently, this may be advantageously medicated by solutions of the chlorides of lime or soda ; as correctives of fœtor, and detergents.

So soon as detachment has begun, a careful examination is made of the subjacent part, more especially at the very margin, in order to ascertain whether the sloughing tendency has been arrested or not. If it has, a healthy surface will be found, either simply ulcerating, or already shewing signs of repair by granulation ; and simple water-dressing is continued. If it has not, the ash-coloured slough will be found again forming ; or rapid destruction is seen advancing, in the phagedænic form. And then the escharotic must be at once and freely repeated ; directing its operation chiefly to the margins, as there the chief tendency to extension of the evil would seem to reside. If need be, such repetition is continued, until the destructive process has been finally and fully controlled.

In the reapplications, nitric acid may be well superseded by the nitrate of mercury ; not as a more efficient escharotic, but as a more successful *alterative* of the sore. It is liable to but one objection, namely, that a burning pain is not unlikely to continue for several hours. This is in part obviated, however, by simultaneous exhibition of the internal sedative and anodyne, as formerly advised ; or chloroform may be used, as a more thorough anæsthetic.

Whatever caustic is used, in no instance should preparatory drying of the part be omitted ; it is as necessary in the last application as in the first. Be it likewise remembered, that this class of sore is communicable by contagion ; that, consequently, much personal cleanliness is demanded towards each patient ; and that, in hospital practice, all community of dressings, and every other circumstance likely to effect conveyance of the contagious matter, must be scrupulously avoided.

In minor cases—or when the use of escharotics is decidedly objected to—milder measures may be employed.

The tartarized iron in solution, or Condyl's fluid (permanganates of potash and iron), pure, or more or less diluted, may be applied as a lotion ; and often they are found to exert a very decided influence in amending the condition of the sore.

On arrest, even partial, of the sloughing and phagedænic processes, by local treatment, the constitutional symptoms undergo a marked improvement. For the effect of the escharotic is not merely to convert both dead and dying parts at once into an eschar ; but also, to oppose constitutional contamination from absorption of deleterious matter, both fluid and gaseous. When sloughing has ceased, when the sloughs are almost separated, and when granulation is fairly established—the characteristic humidity, fœtor, and pain all gone—the febrile disorder will be invariably found to have greatly subsided. Then tonics and generous diet have become expedient, to allay the hectic tendency, and maintain constitutional power sufficient for local repair.

Such being the treatment most suitable to this class of sores, it is very obvious how important it must be, in all cases, to diagnose accurately between what is really of this nature, and mere simulation of it by accidental sloughing in the simply inflamed ulcer ; the one requiring a painful escharotic, with the treatment suitable to constitutional irritation ; the other, merely continuance of bland poulticing, with moderate antiphlogistics.

It need scarcely be added, that in no instance of the genuine form is blood-letting advisable. As already seen, local loss of blood sometimes occurs in the progress of the disease ; occasionally for good, but perhaps more frequently for evil. In all circumstances, it is certainly an event of hazard ; with a leaning to the side of evil, sufficient to forbid its rash institution by the practitioner.

Mercury, too, is not to be thought of. As a general rule in sloughing and phagedænic sores, more especially when of venereal origin, mercurial medicines are always to be withheld ; as certain to prove more or less pernicious—in many cases disastrously so. They aggravate the disease ; and, indeed, the supervention of constitutional disorder attendant on mercurial exhibition is often the cause of comparatively healthy sores degenerating into the sloughing or phagedænic forms.

Peculiarities of Ulcers.

1. Many sores on the lower extremities are accompanied, or rather caused by, a varicose condition of the veins ; and by some the "*Varicose Ulcer*" is entered into the general classification. But, in truth, this term does not express any individual kind ; but rather may comprehend every variety of sore. For all, or almost all, may be attended by, and partly result from, a varicose condition of the veins. The irritable is very common, under such circumstances ; so is the inflamed. The indolent and weak, especially the former, are said by some to be the most frequent types of the varicose ulcer ; but, according to my experience, neither are more common than the irritable. Occasionally, the scrofulous is found complicated with varix. We may have even the sloughing and phagedænic ; and, in that case, profuse venous hemorrhage is to be expected and guarded against. Perhaps the least frequent form is the healthy sore ; as can be easily understood.

Treatment will necessarily vary according to the character of the sore, independently of the varicose complication ; poulticing and rest to the inflamed, stimulants to the weak, nitrate of silver to the irritable, straps to the indolent, etc. But, besides it is of course essential to deal with the obvious predisposing cause, the varix. If this be great and of long standing, and have induced oft-repeated ulceration of a troublesome and grievous nature, the radical cure ought certainly to be attempted ; in the way which will be explained, when speaking of the treatment of that disease. But as this requires confinement for some time, and is not altogether void of danger, in the slighter and more ordinary cases the prudent surgeon contents himself with palliative management. That is, rest and recumbency during the ulcerating and healing processes ; and uniform support, from bandaging or elastic stocking, both then and subsequently.

At the same time, much attention is paid to the lower bowels ; keeping them clear of obstruction ; and thereby removing a cause, not more obvious than common, of both occurrence and continuance of varix in the lower limbs.

2. The lodgment of *foreign matter* may complicate an ulcer ; effectually preventing cicatrization. This may have come from without, consisting of wood, stone, iron, cloth, etc. Or it may have an internal origin ; consisting of necrosed bone, dead tendon, or ordinary slough of fascia or areolar tissue ; the result of suppuration, either then or previously. Of whatever nature, and whencesoever come, the foreign body is amenable to but one treatment—early and complete removal. Some little excitement follows the manipulation necessary to effect that object ; and is to be met by rest, fomentation, poultice, and other usual antiphlogistics. On subsidence, the granulating process begins ; and is conducted under the ordinary treatment.

3. *The Sinuous Ulcer*.—Sinus may co-exist with ulcer ; preceding or accompanying. If it do not fill up and contract spontaneously, keeping pace with the corresponding change in the sore, it is to be treated independently. Pressure, in the first instance, is applied ; direct, and regulated according to the principles formerly inculcated (p. 97). If this fail, then the sinus—usually superficial—is to be laid open ; either by knife, or by potass, as circumstances may render expedient.

If the term sinus be applied to the undermining of integument, and unsoundness of areolar tissue, which invariably characterise the scrofulous sore, then the use of potass to these will be advisable ; for the reasons formerly given (p. 114).

4. *The Pustular Sore (Impetiginous or Herpetic)*.—Sometimes an eruption of pustules, or vesicles soon becoming purulent, takes place on some part of the surface of a limb ; and on the pustules giving way, ulceration continues. The sores, at first inflamed, may become irritable. Often they pass early into the weak form ; not, however, before the previously active stage has considerably diminished the intervening patches of skin. These afterwards assume the healing process ; and proceed lazily and imperfectly in the work of cicatrization. If healing be long delayed, the insular portions of skin thicken, and rise in the edges ; and then the character of Indolent sores may be more or less completely assumed.

This variety of ulcer, in some respects, resembles the scrofulous and cachectic sores. But it differs from both ; in commencing in the superficial layers of the true skin ; in the absence of tubercular product in the inter-ulcerous texture ; and in the absence of any constitutional evil, other than what may be termed common derangements of the general health. Perhaps, in its early stage, at least, it were more naturally ranged among Eruptions than among Sores.

Treatment varies according to the aspect of the part ; sometimes water-dressing ; sometimes nitrate of silver ; sometimes stimulant lotions ; sometimes strapping. Uniform local support and constitutional care are required to prevent relapse.

5. *A peculiar ulcerous affection attacks the foot* ; commencing about the toes, creeping upwards, and at length reaching the ankle. The

part is studded with numerous small sores ; and the skin and areolar tissue are at the same time hypertrophied. The skin is hard too ; giving so far an indolent character to the ulceration. A thin, foetid, unhealthy discharge oozes away ; and sometimes burrows deeply ; but there is little inter-communication of the sores. From time to time fresh inflammatory attacks may occur, causing abscesses, with rapid extension of the sores, which are then prone to assume the characters of sloughing-phagedæna. By and by the nails drop off ; and the matrix ulcerates. The phalanges become carious ; and ultimately the metatarsal bones are similarly involved. The os calcis often suffers at an early period. Pain is always considerable ; and the system is weak and miserable. Sometimes the young are affected ; more frequently those of middle life.

The disease is but little amenable to treatment. In the less advanced cases, rest, bandaging, and the more powerful alteratives, both local and constitutional, may effect cicatrization. But the part is prone to relapse. In many cases, amputation is ultimately required.



Fig. 33.

6. *The Vicarious Ulcer*.—Sometimes sores may be said to be of this nature. In females, for example, ulcers may form on the leg, or elsewhere, obviously connected with the menstrual secretion ; becoming active, enlarging, and emitting a profuse discharge—sometimes sanguinolent—while the menstrual flux is, or should be, in progress ; contracting, becoming dull, comparatively dry, and perhaps partially cicatrizing, during the intervals. Sometimes, on the other hand, the conditions are precisely the reverse ; the sore healing, and remaining healed, so long as menstrual matters are normal, but continuing doggedly open during the period of amenorrhœa. Such sores, it is plain, can be attacked with safety and propriety only through the uterus. The functions of that organ must, in the first instance, be duly restored. Then, and not till then, need our attention be directed to the obtaining of cicatrization. With the uterine system in error, all local applications will be of but little avail ; whereas, uterine health having been restored, the sore will often heal, and that rapidly, without any local treatment whatever.

7. *The Constitutional Ulcer*.—When a sore has existed for many years ; almost stationary, or only varying with obvious changes in the system ; tending to inflammatory extension, during constitutional disorder ; contracting again, when this subsides ; yet never approaching to complete cicatrization, without ill health ensuing ; and this again relieved by re-establishment of the sore :—when the gouty diathesis is strongly marked, and its alternations are plainly connected with an ulcer's varying state :—when the patient is advanced in years, has been in hot climates, and may without injustice be termed a *bon-vivant* :—when an obvious relation exists between the sore and an affection of some internal organ, such as

Fig. 33. The foot so affected. *a*, the toes, much altered ; *b*, the outer side of the foot, in some parts shewing cicatrices ; *c*, the line of amputation, at the ankle ; *d*, the astragalus. The swelling is often much greater than here represented. May this be termed *Podellkoma* ?—*ποδος ελκος*—ulcer of the foot.

the kidney :—under these circumstances, or such as these, we do not think of drying up the sore, which may be truly looked upon as a safety-valve to the system ; but content ourselves with the application of some simple and soothing dressing. We leave what may be termed the ebbing and flowing of the ulcerative process entirely in the hands of Nature ; our dressing tending simply towards comfort and protection.

The healing of such sores is scarcely to be attempted. But there are others which, requiring great caution of interference, may yet ultimately be brought to heal ; an issue, in a convenient situation, having been made to supply their place, for some time at least, as a drain—or rather safety-valve—in the general economy. A sore, secreting constantly a considerable quantity of pus, may have existed for years in the limb of an elderly patient. No prudent surgeon would ever propose to dry up that suddenly, by rapid cicatrization—even if he had it in his power to do so ; without leaving some substitute in its room, at least temporarily. For the sudden cessation of purulent discharge, to which the system had been long habituated, would be certain to occasion a plethora ; this, in its turn, inducing determinations of blood to certain parts. And thus serious danger to internal organs would accrue ; by hemorrhage, sanguineous infiltration, or establishment of the inflammatory process. Apoplectic seizure is especially probable under such circumstances. Yet, doubtless, the continuance of such a sore is not only a considerable inconvenience, but likewise has a debilitating effect on the general system, and consequently tends to the induction of other disease, to whose accession constitutional debility is favourable. Its closure is therefore desirable. And should no unpropitious circumstances exist, as stated in the preceding paragraph, such closure may be safely enough conducted in the ordinary way ; taking care, however, to establish an issue in some convenient and adjacent spot, so soon as the ulcer's discharge begins to lessen. This artificial drain is kept in full operation for some time—a fortnight or three weeks ; and then, by gradually diminishing the bulk of the foreign body, by whose presence healing is prevented and discharge maintained, the system is so gradually subjected to diminution of the waste, that its ultimate cessation is scarcely appreciated.

CHAPTER V.

MORTIFICATION.

MORTIFICATION is the general term which includes the whole process of death in a part, from its commencement to completion. It is subdivided into *Gangrene* and *Sphacelus*; the former denoting the process of dying; the latter, the result of this, or actual death of the part.

Gangrene being about to occur, as a result of the inflammatory process, the signs of this affection become modified. The redness passes into a dark and livid hue; for circulation has ceased, and the blood is becoming decomposed. Circulation having been arrested, so is the formation of new matter, and the swelling grows less tense. On the surface, however, effusion of serum may take place; and that profusely. All vital function decaying, pain and heat remarkably abate, and often cease suddenly. Sensibility gradually leaves the part. Just before, it could not be pressed on, however slightly, without aggravation of pain, previously severe; now, even rude handling may be borne with impunity. Nutrition, the source of animal heat, having ceased, temperature necessarily decreases, and usually with rapidity. The part contains much inflammatory product, chiefly fluid; putrescence increases both softening and moisture; and, as the result of chemical change, an offensive odour is more or less freely exhaled. The surface is usually studded with *phlyctence*; that is, elevations of the scarf-skin by putrid serum; readily distinguished from the dark vesicles filled with bloody serum which not unfrequently attend on simple bruise, by observing that the epidermis is detached from the cutis not only at the elevated spot, but all around; and that, consequently, the phlyctena may be made to slide from place to place, by slight pressure. Besides, the phlyctena is not attended with heat, pain, and tension, as is the mere vesicle; while it is associated with all the symptoms of advancing gangrene. When this is limited to the part originally inflamed, the discoloration is circumscribed, and may have its border even abrupt; but when the disease, and injury which led to it, have both been severe—when the power of both part and system have been brought low—and when, in consequence, gangrene is to spread—discoloration is gradually lost in the surrounding skin, and dark streaks are seen shooting diffusely upwards in the limb.

Sphacelus, or completion of the gangrene, is indicated by the part having become completely cold and insensible. It is shrunk in its dimensions, soft and flaccid, almost pulpy to the touch; and it crepitates distinctly, containing not only liquid but gaseous contents—the result of putrescence. All vital function has ceased, and chemical change reigns paramount. The colour is usually dark when the part is exposed to

atmospheric influence ; but when removed from this, as in sloughing of the areolar tissue, or of fascia, and in necrosis—the integuments remaining yet entire—the dead portions may retain their normal character but little changed.

In chronic gangrene, the dead part, instead of being moist and soft, becomes dry and hard ; the fluids passing away.

When a part dies to a limited extent—as a portion of skin, areolar tissue, artery, or tendon—the sphacelated part is termed a *Slough* ; and the process of death, *Sloughing*.

Sphacelus being complete, and gangrene not extending, Nature instantly adopts means whereby she may free herself from a part which is of no further use, and whose continued presence may prove seriously injurious. Its recovery is impossible ; and if it be allowed to remain in close contact with the living textures, these cannot fail to absorb more or less of the noxious results of putrescence, both gaseous and fluid ; whereby a poisonous effect will be produced on the system, already brought low by constitutional disorder attendant on the gangrene. The living part, in immediate contact with the dead, inflames ; and, in consequence, the abrupt livid line is bordered by a diffuse, red, and painful swelling—the *line of demarcation*. This vesiculates ; the vesicle bursts ; puriform matter is discharged ; and an ulcerating surface is disclosed—the *line of separation*. The furrow, so begun, gradually deepens ; at first advancing with considerable rapidity, through the skin and areolar tissue ; but receiving a check, when fascia, tendon, or other fibrous texture is reached. The advance is seldom perpendicular, but in a sloping direction ; and the inclination is usually towards, and, as it were, beneath the dead part ; gangrene generally being most extensive superficially. In time, even the most resisting of the soft textures are got through by ulceration, nothing but bone remaining undivided. No hemorrhage occurs during this gradual division of the parts ; for the inflammatory process has passed leisurely through its ordinary grades ; plastic formation precedes the suppuration and ulceration, protecting the otherwise loose tissues from diffuse suppuration, and sealing up the otherwise open orifices of arteries and veins.

Nature's amputation, so conducted, is unfortunately a reverse of the surgeon's operation ; producing a stump which is conical, and otherwise but ill-fashioned for useful purposes. We are, therefore, called upon to interfere in most cases ; modifying the arrangement, and securing division of the bone at a higher point.

We have been hitherto supposing that gangrene has involved the whole thickness of the limb ; the line of separation forming on the car-



Fig. 34.

Fig. 34. Complete sphacelus of foot and ankle. Detachment all but complete. The sloping line of separation well shewn ; studded with granulations.

diac aspect of the sphacelus, and sloping downwards. When gangrene is less extensive, the process of separation is still the same ; ulceration, on every aspect of the slough, until the dead portion is fairly separated from the living. On its separation, ulceration, still advancing, may be found beneath. But usually it is not so ; the appearances are rather those of a healthy granulating sore. The inflammatory advance is seldom greater than what is merely sufficient to secure disintegration and removal of that layer of living texture which is in contact with the dead part, for the purpose of separating and throwing off the latter ; and, at every point where separation has been effected, ulceration usually ceases ; giving place to granulation, which then slowly effects a closure of the breach. Ulceration is the agent which makes the furrow ; repair by granulation follows closely on its heel. And so it is in regard to dead bone ; the line of separation is scarcely visible between the dead and living, when already preparations for the substitute bone have been begun.

Constitutional Symptoms of Mortification.

During the early period of the inflammatory process, the constitutional symptoms are usually those of Inflammatory Fever ; but so soon as gangrene has commenced, these symptoms pass more or less rapidly from the inflammatory type, to the *Typhoid* form of Constitutional Irritation. The disorder has been so well described by Mr. Travers, in his work on Inflammation, as to render a transference of the passage entire more than excusable. “The pulse is increased in frequency, and diminished in diameter and force ; in many cases irregular, and in some intermitting. A peculiar anxiety of expression appears in the physiognomy, and a remarkable livor overspreads the face, the features of which, the nose and lips especially, are contracted and pinched. The anxiety is soon exchanged for a hebetude of expression, as if the patient were under the influence of alcohol or opium ; involuntary movements and tremors affect the hands and fingers, and frequent sighings are observed, which are broken by occasional hiccup. The inclination for food fails totally, the surface of the tongue is coated with a brown fur, harsh and dry, leaving the edge and tip free, but without moisture. As the case advances, the entire tongue, fauces, and lips, become dry to incrustation, so as to require constant moistening ; but with small quantities of fluid, for swallowing is slow, and attended with difficulty. The skin, which in the onset was dry, opens to a copious but clammy perspiration over the whole surface. It parts sensibly with its temperature, and feels cold as well as damp. The mind, at first irritable—then, after the total subsidence of pain, stupid—wavers, and becomes subject to illusions, chiefly of a passive and transient kind ; expressed by half sentences, with a thick and broken articulation, and accompanied with startings and momentary gleams of insane excitement. In traumatic gangrene—the age and constitution being previously in full vigour—this low delirium is exchanged for fits of active and wild frenzy, accompanied with loud cries and vehement efforts, requiring a powerful and continual restraint ; and this continues, with occasional intervals from exhaustion, for hours together ; and subsides, often suddenly, in prolonged coma and apo-

plectic death." When but little of sthenic indication has preceded the gangrene, as in constitutions previously much weakened, or in the case of poisoned wounds inducing rapid death of the part, the delirium continues of the passive kind. The sphincters relax, and the excretions are passed involuntarily. The patient fumbles with and picks at the bedclothes. More and more marked are "the death-like coldness, the clammy sweat, the small, indistinct, and flickering pulse, and the cadaverous expression. In this state a patient will sometimes lie totally insensible, and unable to articulate or swallow, for eighteen or twenty-four hours, and die without a groan or struggle."

Such is the character of that general disorder which attends on gangrene. Death of the part is a direct shock to the frame, previously the seat of febrile disturbance ; and this depression is doubtless aggravated, by subsequent absorption of noxious matter from the moist and crepitating mass. The symptoms are found to vary, as is to be expected, according to the previous condition of the patient, the extent of the gangrene, and the importance of the part in which it has occurred. When the vital powers have been previously low ; when the mortified part is vast ; when an internal organ has perished, even in a patch or speck only—the constitutional symptoms are invariably grave, and point to a fatal issue.

As certain tissues are found endowed with a faculty of resisting ulceration, so some are less prone than others to gangrene ; for example, the nervous and arterial. In acute hospital gangrene, arteries are found beating in the dark and putrid mass ; alive, while all is dead around them ; but at length they also yield, and death is hurried on by hæmorrhage.

Other tissues, again, are especially prone to mortify ; as, for example, the cutaneous and areolar. And this obviously explains the sloping form which the line of separation generally assumes, when gangrene has invaded the entire thickness of a limb.

When mortification occurs in an internal part, many of the ordinary signs are of course absent ; and yet the symptoms are plain enough. We have not before us the blackness, nor the coldness, nor the crepitation ; but we have sudden cessation of pain, previously most severe ; failure of the pulse, and prostration of the strength ; clammy sweat, collapsing features, and hiccup. These having occurred, we may confidently look for the other constitutional symptoms of gangrene, above enumerated. In short, it is important for the practitioner to bear in mind, in the management of acute internal disease—as, for instance, in the case of strangulated hernia—that the combination of hiccup and marked prostration, with sudden cessation of pain, plainly tells him of gangrene having occurred in the part inflamed ; and that he is to frame his prognosis accordingly.

The ordinary division of mortification is into *Acute* and *Chronic* ; *Acute* comprehending the humid, inflammatory, and traumatic ; *Chronic*—the dry and idiopathic. Generally speaking, the acute is humid, and the chronic dry : the fluids being retained in the one case, and parted with gradually in the other. But this is not invariably the case.

Causes of Mortification.

The cause of mortification may be broadly stated to be, whatever is opposed to vital power. But it will be convenient to examine this statement more in detail ; considering separately those causes of local death which most frequently come under the notice of the surgeon.

1. *The inflammatory process* we have already seen to be a very frequent cause of mortification ; by intensity of the process ; by want of vital power—in part, system, or both—to control the process ; or by a conjunction of both circumstances. The gangrene may be said to be invariably humid ; for not only is there no dissipation of the normal fluids of the part, but an absolute and decided increase of them by inflammatory product.

2. *Mechanical injury* may occasion local death, either directly or indirectly. The violence may have been so great, as at once to crush and disorganize the part ; instantly depriving it of life. Or, less intense,



Fig. 35.

it may have but lowered vitality by partial disruption of texture ; at the same time acting as a powerful excitant of the inflammatory process, and so rendering the occurrence of gangrene by inflammatory change all but inevitable. Both forms are sufficiently common ; and both, but especially the latter, are prone to spread rapidly, greatly endangering life by poisoning of the system. The mortification is acute and humid.

3. *Pressure*, gently applied, occasions absorption ; a higher grade induces the inflammatory process in its minor grades ; a higher causes suppuration and ulceration ; and a higher still occasions death of the part. The last result may be either direct or indirect ; that is, with or without the intervention of inflammatory change. Pressure being considerable and constant, with a low power in both part and system, death of the former may be immediate ; as may often be observed, in the formation of bed-sores. Or, as was stated of mechanical injury in general, pressure may excite the inflammatory process and lessen vital power simultaneously ; so rendering the part an easy prey to the former.

4. *Heat*, in like manner, may be so intense as at once to char the part ; rendering it instantly dense, black, and brittle ; as in the severest class of burns. Or it may only diminish power, and excite inflammatory accession ; as in the more common examples of this form of injury. *Acids*, and other chemical destructives, act in a similar way.

Fig. 35. Gangrene after compound fracture ; still spreading ; no line of demarcation.

5. *Obstruction to Venous Return.*—The gangrenous effect of this is indirect. Passive congestion is induced ; and so long as the obstacle to venous return continues, venous accumulation, with consequent effusion

into the surrounding parenchyma, is inevitably increased. This abnormal state, necessarily weakening vital power, is also likely to excite the inflammatory process, as formerly shewn ; and then, but a slight amount of this may suffice to arrest vitality. Thus, gangrene of the whole fore-arm has resulted from injudicious bandaging, or other deligation of the arm ; no support having been afforded to the parts beneath.

Or the obstruction may be by spontaneous change in the principal venous trunk ; as by coagulation of its contents. Or it may be the result of compression by tumours of various kinds ; or by organic change in internal organs—as the liver and heart.

6. *Deprivation of Nervous Agency* also acts indirectly. Bed-sores, by sloughing, are well known to be most prone to form in cases of injury of the spine ; the pressed parts being paralytic. Power is diminished, a tendency to inflammatory accession is induced, and the application of a comparatively slight stimulus suffices to ensure the gangrene.

Sometimes, no direct exciting cause is necessary. The cornea has sloughed after division of the fifth nerve ; the same act at once arousing the inflammatory process, and cutting off the nervous agency.

7. *Interruption to Arterial Supply.*—This may be complete ; causing a direct cessation of life. A

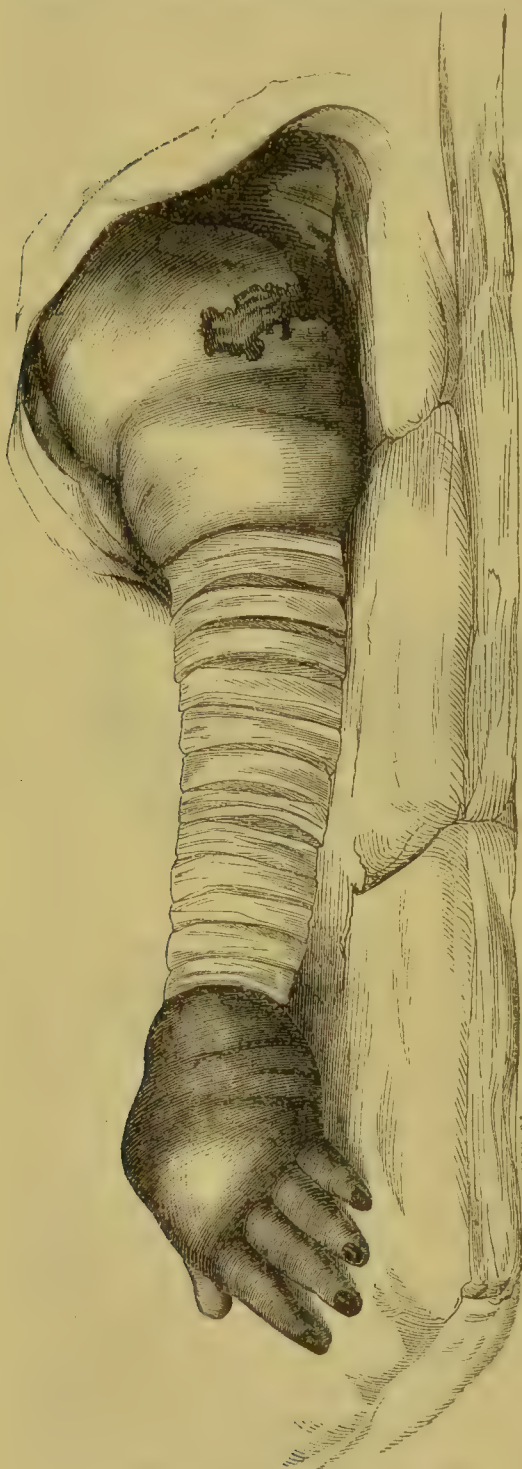


Fig. 36.

tourniquet placed and retained so tightly on a limb as to arrest entirely its circulation, inevitably entails death of the whole limb beneath the encircled point ; for, invariably, on complete arrest of circulation, the vital process ceases, and chemical change begins. Besides, ordinarily,

Fig. 36. Gangrene from strangulation of an injured limb by absurd bandaging. JOHN BELL.

arterial influx can be effectually arrested only by such means as must at the same time cut off all nervous influence ; rendering retention of vitality, if possible, still more hopeless. Or the instrument may be applied with tightness sufficient to diminish, yet not so as to stop arterial influx. And then the result will be indirect, as in the case of obstruction to venous return only ; the inflammatory process being excited, while power is depressed. Or, after deligation of the principal artery of a limb, weakening vital power—inasmuch as collateral circulation can never be, at first, quite equal to the normal arterial supply—heat, friction, or other stimuli are applied ; and gangrene occurs in consequence.

The first of these modes of death is comparatively a painless process ; being immediate. Pain ensues only on inflammatory accession, in the adjoining living parts, whereby the line of separation is formed. The second mode is painful ; because tedious, and inflammatory throughout. And this it is important to remember. When we wish to get rid of a tumour, for example, or other noxious structure, not amenable to excision, we employ ligature. If we wish further, that the destructive process should be both speedy and easy to the patient—as doubtless, in the vast majority of cases, will be our object—we do not hesitate to put him to immediate pain, by tying the ligature with as tight a strain as it will bear ; so as to cut off thoroughly its arterial supply, and altogether arrest its circulation. Whereas if, unwisely—and unmercifully—we treat him now with a gentle hand, much unnecessary pain remains for the future. The part, being but partially strangled, remains capable of assuming the inflammatory process ; and the undergoing of that painful process, in the circumstances, is essential.

The most obvious illustration of this cause of gangrene is deligation ; from without. But equally efficient obstruction to arterial supply may come from within ; by rupture of the principal artery, or arteries ; by consolidation of their canals, from embolism or from fibrinous formation of a plastic kind ; by earthy degeneration of the vessels, as will afterwards be shewn ; or by rupture and diffusion of an aneurism.

Perhaps the tendency to gangrene, in inflaming textures of an unyielding kind, may be caused, at least in some degree, by the tension which invariably ensues ; this so compressing the part, as either to arrest, or seriously impede, the already weakened circulation.

In surgical operations, it is very useful to bear in mind that sudden and effectual obstruction of both arterial influx and venous return is likely to prove fatal to the part. For instance, in tying the principal artery of a limb, on account of aneurism, we should be especially careful to avoid injury to the accompanying vein ; for, if that be obstructed, as well as the artery, gangrene of the limb—even without the intervention of undue stimulus—is extremely probable. If we can imagine the principal nerve to be at the same time seriously injured, gangrene is all but inevitable ; under the threefold evil influence, of arterial and venous obstruction, with deprivation of nervous energy.

8. *Cold*.—The effect may be direct or indirect ; more frequently it is the latter. But direct it may be ; thus. The immediate effect of cold, intense, and continuously applied to the part, is greatly to depress both its circulation and its nervous energy ; and this depression, by con-

tinuance of the cause, may be carried so far as altogether to annihilate vital power. The part, in truth, is frozen to death ; becoming cold, insensible, shrivelled, and discoloured ; by and by undergoing obvious chemical change, and becoming detached by the ordinary process of separation. This is likely to occur only in very cold climates ; and even then, only when the individual is exposed to hardship and privation. The parts most liable to be so affected, are those most remote from the centre of circulation, and consequently by nature less fully endowed by vital power ;—and also those most habitually exposed to atmospheric inclemency—as the toes and feet, and the tips of the nose and ears.

Much more frequently the action is indirect. Cold is applied ; and the lowering result follows, as usual, to a greater or less extent. Then the cold is suddenly removed ; or, very likely, warmth with the addi-



Fig. 37.

tional stimulus of friction is applied. And the inevitable consequence is immature and excessive reaction in the tissues of the part, followed by dilatation of the blood-vessels, and the admission of blood rushing back ; thus hurrying on the inflammatory process in a part whose vital power has been enfeebled. The inflammatory onset is sudden and intense ; power of resistance and control is low ; gangrene is inevitable. It is not the patient who is simply exposed to diminished temperature, that suffers from chilblain—chronic inflammatory process in a debilitated part ; or from frost-bite—the inflammatory process, more acute, having reached sloughing. But it is the patient who, after exposure to cold, warms himself at the fire, or simply enters a heated room ; or who, not contented with abstracting cold, and applying heat, adds friction to the affected part.

Illustrations of this are of constant occurrence ; but there is one, on a large scale, which, though trite, is altogether so apposite and striking, that it may be well, by way of corroboration, briefly to notice it here. In his narrative, after the battle of Eylau, Baron Larrey says—“ During three or four exceedingly cold days that preceded the battle, the mercury having fallen so low as fifteen degrees below zero of Reaumur’s thermometer, and until the second day after the battle, not a soldier complained of any symptom depending on freezing of the parts ; notwithstanding

Fig. 37. Chronic gangrene of the feet, after exposure to cold. Separation considerably advanced.

they had passed three days, and a great portion of the nights of the 5th, 6th, 7th, 8th, and 9th of February, in most severe frost. The Imperial Guard, in particular, had remained upon watch in the snow, hardly moving at all for more than twenty-four hours ; yet no soldier presented himself at the Ambulance. In the night of the 9th and 10th, the temperature suddenly rose ; the mercury ascending to three, four, and five degrees above zero. From this moment, many soldiers of the guard and line applied for assistance ; complaining of acute pain in the feet, and of numbness, heaviness, and prickings in the extremities. The parts were severely swoln, and of an obscure red colour. In some cases, a slight redness was perceptible about the roots of the toes, and on the back of the foot. In others, the toes were destitute of motion, sensibility, and warmth ; being already black, and as it were dried. All the patients assured me that they had not experienced any painful sensation during the severe cold, to which they had been exposed on the night-watches. It was only when the temperature had (suddenly) risen, eighteen or twenty degrees, that they felt the first effects of the cold as inducing mortification.* And it is added, that those who had warmed themselves at fires suffered most.*

But cold may, in a similar way, cause death, not of a part, but of the whole body. General vital power is depressed ; sudden reaction ensues, by the imprudent use of stimulus ; and, under this, the enfeebled system may succumb. In illustration, let us again quote from Larrey : —“Wo to the man benumbed with cold.....if he entered too suddenly into a warm room, or came too near to the fire of a bivouac.....Gangrene made its appearance at the very instant, and spread with such rapidity that its advances were perceptible by the eye. Or the individual was suddenly suffocated with a kind of turgescence, which appeared to affect the brain and lungs ; he perished as in asphyxia. Thus died the chief apothecary of the Guards.....He had scarcely been a few hours in this (warm) atmosphere, so new to him, when his limbs, in which he had lost all feeling, became considerably swelled ; and he expired soon afterwards, incapable of uttering a single word.”†

The use of alcohol, in any considerable quantity, during exposure to cold, favours these untoward results. For a short time its stimulant action rouses the circulation, and gives at least a sensation of heat ; but ere long the reaction comes, leaving a depression greater than that which existed before the application of the stimulus. The spirit of wine, in the vital barometer, rose quickly to some height, but fell as rapidly, *and sank below the starting point.*

9. *Animal and other Poisons*, applied to a part, by inoculation or otherwise, are usually said to be powerful excitants of inflammatory gangrene. That is, they lower vital power, in both part and system ; at the same time exciting the inflammatory process in the vicinity of the wound. Bites of serpents act in this way ; as also inoculation of putrid virus, from cattle, or others of the lower animals, occasioning the “malignant pustule.” And, much in the same way, there is no more certain cause of rapid and extensive gangrene, with most serious results to the system, than by the infiltration of urine into areolar tissue.

* Larrey's Memoirs, tom. iii. p. 60.

† Op. Cit. tom. iv. p. 134.

Hitherto, we have considered chiefly such causes as are local and external ; we now come to those which are constitutional and internal.

10. *General debility*, from any cause—hemorrhage, starvation, age, persistent disease, or long continuance of any generally depressing agent—predisposes to both inflammatory accession and its untoward advance ; there being but little power, either in part or system, for resistance or



Fig. 38.

control. Or vital power may be so far diminished, especially in those parts naturally the weakest—being most removed from the centre of circulation—as to cause death in a more direct way, without the intervention of the inflammatory process ; simply by mal-nutrition, and gradual failure of vitality in consequence. This latter mode is not unfrequently exemplified by simple gangrene of the toes after exhausting fever.

A peculiar disorder of the system, certainly not of the sthenic type, attends on the internal use of mercury carried to sustained ptyalism. This seems very favourable to assumption of the inflammatory process ; and to the invasion of sloughing, as well as of fierce ulceration, during its progress ; a fact abundantly exemplified by the frequent occurrence of sloughing and phagedæna, in an aggravated form, in venereal patients salivated recklessly.

11. *Improper food*, habitually taken, leads to disorder of the system of a feeble type ; and thus will, at least, predispose to gangrene. But one poisonous article of diet, in particular, causes constitutional disorder of a very aggravated character ; an almost invariable result of which is chronic and dry mortification of the extremities. The article alluded to, is an unsound kind of rye ; not uncommon in the north of Europe. A black, curved excrescence, not unlike the spur of a fowl, grows on the spike, and sometimes is found in such quantities as to form nearly one-fourth of the produce of the rye. It is termed the Ergot of rye, or *Secale cornutum*. Its habitual use, as food, induces lassitude, weakness of the extremities, a feeling of intoxication, and periodic convulsive movements. This state, called *Raphania*, may continue for days or months. And frequently, during its persistence, mortification of the extremities occurs ; beginning in the toes, and gradually extending up the leg ; attended with but little pain, and without appreciable precursory inflammatory change ; the part becoming at once cold, insensible, and discoloured, and gradually dry, hard, and shrivelled. In some of the recorded cases the line of demarcation formed, separation was completed, and recovery took place. In the majority, however, the disease advanced, unchecked in either its

Fig. 38. Chronic gangrene ; from general debility. Line of separation begun. Patient æt. seventy-five.

constitutional or local form ; and the issue was fatal. In this country, a somewhat similar malady has been traced to the use of unsound wheat.

12. *Atmospheric influence* acts favourably, or otherwise, on the system ; more especially of the invalid. When a deleterious impression has resulted, no uncommon indication of this is the appearance of sloughing in a previously healthy wound or sore. To such a cause, for example, the invasion of hospital gangrene is perhaps most frequently attributable.

13. *Arterial degeneration*.—In advanced years, the whole arterial system, but more especially its ramifications in the lower extremities, are liable to degenerate ; by the formation of calcareous matter between the coats, to a greater or less extent ; sometimes converting them into completely rigid, and as if altogether calcareous tubes. This, of itself, may exist so generally, and in so advanced a form, as ultimately to render efficient circulation through such altered conduits impracticable ; and, circulation gradually ceasing, so does life. Death of the part ensues ; a gradual and painless process. Or, without disease in the vessel itself, *embolism*, or plugging of the arterial channel by a clot or excrescence which has formed elsewhere, in the heart or larger arteries, takes place. The clot or excrescence is detached by the force of the current of blood, and, carried onwards, passes along the vascular channels till it reaches a vessel of such diminished size as to bar its farther progress. Or the obstruction of an artery may occur in still another way :—coagulation of the fibrin of the circulating blood commences upon the diseased surface of the inner coat of some part of an artery, to which further addition is gradually made till the vessel becomes obstructed more or less completely to the next collateral branch above and below. And slow though such processes be, they suffice to cause more or less extensive gangrene, according to the extent of arterial communication which has become obstructed, and the degree of dilatability in the collateral circulation—fitting it for maintaining an efficient and nutritive supply in the extremity.

This obstruction of the arterial circulation has been attributed by some to the inflammatory process in the coats of the vessels producing copious fibrinous product, which by its coagulation in the interior of the vessel obliterates its channel. By Dupuytren it was imagined that the greater number of cases were thus to be accounted for. But, believing firmly in the three first-mentioned causes of arterial obstruction, and without denying the occurrence of this last pathological process, or that it does sometimes so cause mortification in the aged, it seems more reasonable to believe, that the painful and creeping inflammatory form of this disease is attributable not so much to the occurrence of arterial obstruction as to the vital weakness of the part, and its complete invasion by the inflammatory process.

Thus we find the old man peculiarly exposed to mortification, particularly in the parts naturally most weak—the feet and toes. To such mortification, usually gradual, chronic, and dry, the term *Gangræna senilis* is commonly applied. This disease, however, is not to be considered as invariably occurring in one way, and consequently in all cases amenable to one and the same mode of treatment ; otherwise, much practical evil must result.

Senile gangrene varies in its nature. It is not necessarily attended

by symptoms of arterial obstruction. And when not so accompanied, but apparently induced by simple general debility, incidental to advanced years, and perhaps aggravated by casualties to which every age is liable—it may occur with or without inflammatory intervention. Circulation and vital power may gradually and simply cease ; or the latter is overborne by accession of the inflammatory process. When calcareous degeneration or other cause of arterial obstruction does exist, there is a similar alternative of events ; the gangrene may be inflammatory or not ; acutely painful, or comparatively painless.

In practice, perhaps the most important division of this form of mortification, is into that which is preceded and accompanied by the inflammatory process, and that which is not. For, to the variety of cause, ought the mode of treatment to be accommodated.

The accompanying inflammatory process is always of rather a low type ; the part, of enfeebled power, being not only easily overcome by such, but really incapable of assuming a process of high intensity. In consequence, the term *Inflammatio debilis* is often applied.

Or the inflammatory and non-inflammatory forms may be blended. The latter may seize on one or more toes ; converting them, simply and quietly, into black and shrivelled eschars. After a time the mortification ceased to extend upwards. As usual, an effort is then made by Nature, to throw off the dead and noxious parts ; and this, we know, can be effected only in one way, by inflammatory change and ulceration. The process is accordingly assumed, at the living margin ; and heat, redness, swelling, pain, appear there. But the part has no sufficient power of control ; the desired result of ulceration and suppuration is quickly overpassed ; and mortification ensues. The inflammatory has become engrafted on the simple form ; and proceeds rapidly, with much pain and constitutional disturbance. It would seem as if the attempt towards arrest and separation were being constantly made, and never with success ; on the contrary, accelerating the destructive progress.

Thus, then, we may have senile gangrene throughout unattended with pain, redness, swelling, or other signs of the inflammatory process ; excepting, ultimately, at the line of successful separation. Or, from the beginning, these are present ; and continue until either arrest of the disease, or death of the patient ensue. Or the pain, heat, and redness, though at first absent, may supervene ; and then continue of an aggravated character.

The disease is most liable to occur in males, of the higher ranks ; who have indulged, freely and habitually, in the pleasures of the table—all the more likely, if organic disease of the heart or aortic valves be present. And the most frequent form, is that which is preceded and attended by the *inflammatio debilis*. The original description by Mr. Pott merits quotation. He calls it “ that particular kind of mortification, which, beginning at the extremity of one or more of the small toes, does, in more or less time, pass on to the foot and ankle, and sometimes to a part of the leg ; and, in spite of all the aid of physic and surgery, most commonly destroys the patient.” Usually “ the patients feel great uneasiness through the whole foot and joint of the ankle, particularly in the night, even before these parts shew any marks of distemper, or before there is

any other than a small discoloured spot on the end of one of the little toes. It generally makes its first appearance on the inside, or at the extremity of one of the smaller toes, by a small, black, or bluish spot : from this spot the cuticle is always found to be detached, and the skin under it to be of a dark red colour. Its progress, in different subjects, and under different circumstances, is different ; in some it is slow and long in passing from toe to toe, and from thence to the foot and ankle ; in others its progress is rapid, and horribly painful. It generally begins on the inside of each small toe, before it is visible either on its under or upper part ; and when it makes its attack on the foot, the upper part of it first shews its distempered state, by tumefaction, change of colour, and sometimes by vesication ; but, whatever it is, one of the first marks of it is a separation or detachment of the cuticle."

The constitutional symptoms are such as characterize gangrene in general ; that is, constitutional irritation, tending towards typhoid collapse ; but chronic in its nature, like the local affection.

The *Progress* of mortification is sometimes slow ; making but little advance in days and even weeks—as in the senile, and other chronic forms. Sometimes it is fearfully rapid ; as in the acute and traumatic ; spreading, within a few hours, over a whole limb.

When arrest has occurred, Nature begins her process of *separation* ; as formerly described. A sthenic inflammatory process is established in the living margin ; suppuration and ulceration supervene there ; and this destructive process is in its turn followed by granulation, and effort towards repair. At the same time, the symptoms of constitutional irritation gradually subside ; and a sthenic and normal state of system is restored.

Prognosis varies, according to the extent of the mortification, the nature of the part in which it has occurred, and the condition of the system during and before its accession. The larger the gangrened part, the greater its importance as a portion of the general economy, and the lower the constitutional powers, the greater is the danger to life.

Treatment of Mortification.

The treatment of mortification resolves itself into five principal indications. Remove, or mitigate the cause ; wait for the line of demarcation ; assist Nature, in her efforts towards detachment ; promote and regulate the healing process ; and maintain due power of system, throughout invasion, arrest, and cure.

But, in the first place, let diagnosis be accurate ; be sure that it is a case of gangrene. In mere bruise, there is discoloration of a livid hue ; and dark-coloured serous vesicles form, somewhat resembling phlyctenæ. But the points of difference, formerly noticed, are sufficiently plain. And it is well that such is the case ; inasmuch as error of diagnosis would infallibly lead to serious error of practice. On undoing a fractured limb, for example, after the first application of retentive apparatus, it is not uncommon to find it swoln, discoloured, and studded by dark vesications. If this be gangrene ; amputation, at some distance above the parts so

affected, cannot be too soon performed. It it be but the effects of bruise, reapplication of retentive means, avoiding undue pressure or constriction, are all that the circumstances require.

In the acute inflammatory form, removal of the cause is to be attempted, by antiphlogistics. And, prevention being better than cure, it will of course be advisable to have recourse to these early and efficiently ; so as to arrest the inflammatory progress timeously, and save the vitality of the part. But let not the chance of immunity from gangrene be purchased at too high a cost. Copious general blood-letting, with other spoliative and depressing remedies, may make much impression on the inflammatory process ; and so limit at least the occurrence of gangrene, at the time. But the process of separating the dead parts, followed by attempts at repair, has to come, with its exhausting discharge ; the powers of the system are certain to be severely tried ; and if they have been at the outset imprudently exhausted, they cannot fail to sink when they are most required. Besides, bleeding may not secure even the temporary benefit ; on the contrary, general and local power may be so weakened thereby, as to render these textures an easier prey than they otherwise would have been.

Often antiphlogistics are thus used, with a blind and rash improvidence. The cure is protracted and embarrassed ; the system is enfeebled, and perhaps for ever broken ; or even the issue may be fatal: Cases of threatened gangrene, after severe bruise, laceration, fracture, etc., afford abundant illustration of this practical point. The ulterior result must always be regarded, along with the present ; and both provided for. We are to prevent or limit gangrene if we can : yet using antiphlogistics so as to make sure of leaving power enough of system, for defence from hectic and exhaustion during the suppurative stage.

Also let it be borne in mind, that it is only before, and at the very commencement of gangrene, that antiphlogistics can ever be actively employed. When mortification has been fairly established, the symptoms change, and require a corresponding alteration of treatment ; inflammatory fever, sthenic, is superseded by asthenic constitutional irritation. And further, when gangrene is both certain to occur, and to prove extensive, the symptoms corresponding to that result are often foreshadowed in the characters of the preceding inflammatory attack both locally and generally ; modifying these in so marked a manner, as at once to enlighten the experienced practitioner regarding the impending issue. In such a state, not unfrequently connected with a previously debilitated power of system, antiphlogistics, at however early a period employed, must invariably be used with the greatest caution and forbearance. On the other hand, if the inflammatory attack be intense, limited, seated in an important part, with both local and general symptoms plainly sthenic in character, and occurring in a robust unbroken frame—we may bleed copiously and fearlessly ; employing also the other suitable antiphlogistics with energy. For, in these circumstances, such are the only true preventives of gangrene.

Constitutional remedies, foolishly held as specifics, and termed *Antiseptics*, were at one time much in vogue ; and may not yet have fallen altogether into desuetude. Of these, the most prominent was bark ;

given in full doses. The exhibition of this, at an early period, will plainly aggravate the disorder ; offending the stomach, increasing the fever, influencing the inflammatory progress unfavourably, and rendering the gangrene both more speedy and more extensive than it otherwise might have been. It can only be of use, as other tonics, after the inflammatory accession has gone by ; limiting or preventing hectic, and assisting the system to bear up under the exhausting influence of suppuration.

Previous to gangrene by inflammatory change, then, antiphlogistics are expedient ; early, active, yet cautious ; invariably controlled by regard to the impending future ; their object being to prevent local death if possible, and yet not seriously to impair general power. When gangrene has occurred, they may be continued, in sthenic cases ; but now with still more caution ; to limit mortification as much as possible, but still without injury to the system. When, however, the constitutional symptoms of gangrene are fully developed, of their usual type, antiphlogistics are wholly unsuitable. The disorder has passed from inflammatory fever, into a grave form of constitutional irritation, tending to collapse ; and calmatives, support, tonics, stimuli, will probably be required. Opium, in full doses, and frequently repeated, is an admirable remedy at this stage ; calming the general system, blunting the sensation of pain and illness, and seeming to impart a power of tolerance to the frame under the depressing agency of the local change. At the same time more or less stimulus is usually indicated ; and the preferable forms are the alcohols, and ammonia ; administered with the cautions formerly explained.

Hiccup is particularly troublesome in many cases. If it do not yield to general treatment, musk, camphor, ammonia, naphtha, may be employed as special correctives.

When gangrene has ceased, and separation commenced, usually the general symptoms again change towards the sthenic form ; and, in consequence, a guarded and somewhat antiphlogistic regimen may then perhaps be expedient ; lest the process necessary for detachment should prove excessive, and re-induce sloughing. But, on the contrary, should both general and local appearances betoken debility, cautious support by nourishing food, and the more simple tonics, must be maintained. When detachment has been completed, we have then to do with a simple sore—inflamed, ulcerating, granulating—weak, irritable, or healthy—as the case may be. And the ordinary treatment is to be conducted accordingly.

Mortification by *Pressure* very frequently engages the attention of the practitioner ; a common result of long confinement to the recumbent posture, especially in the weak and paralytic ; sometimes occasioned by inaccurate or injudicious adjustment of retentive apparatus, in the treatment of fracture. When sloughing, in such circumstances, has been induced, it proves a source of much inconvenience to both patient and surgeon ; as can be readily understood. It is to be avoided, by care in subdividing the pressure among many points, so as to avoid its concentration and maintenance on one or two alone. In fracture of the leg, for example, retentive means will be arranged to compress not solely the malleoli or the heel, but to be equally borne by the whole surface of

the bandaged limb ; and such precautions are especially desirable in the case of the aged and weak. When bed sores are threatened, the points naturally most compressed—over the sacrum, trochanters, heels, scapulæ, elbows—must be relieved, as much as possible ; by frequent variation of posture ; by the adjustment of pads, or pillows, on the adjacent parts ; and, if need be, by the use of these admirable contrivances for such purposes, the water-bed or pillow by which the labour of support is equally distributed on every part of the surface.

The reddened and painful parts are to be pencilled over with nitrate of silver, either in substance or in solution, so as merely to blacken the skin. Or a solution of corrosive sublimate may be used ; which has the effect of hardening the part, and rendering it less susceptible of the influence of pressure. Covering the parts, from time to time, with a mixture of white of egg and alum, sometimes makes a very useful protective crust. At the same time, of course, our utmost efforts will be directed towards the general recovery of the patient ; in order that recumbency may become unnecessary. When breach of surface has ensued, it early assumes the weak character ; requiring stimulating applications, accordingly.

When *mechanical or chemical injury* is the cause, we have seldom the power of altogether preventing mortification ; limitation is our object. So soon as the first shock has passed over, our treatment is so far antiphlogistic ; in order that death may be confined to the parts which suffer directly from the injury. We seek to save those which, with their vital power diminished, might still contrive to live, if let alone ; but which would be unable to contend successfully with a brisk inflammatory accession. A certain amount of this must ensue, no doubt ; but we are anxious to limit it to what is really necessary to effect detachment of the original slough. During the progress of detachment, the antiphlogistic regimen will probably be expedient. Thereafter, by improved diet, and other tonic means if necessary, the general power is to be maintained ; sufficient to ward off hectic, and duly carry forward the operation of repair.

In regard to mortification from *Cold*, it is our duty to prevent the occurrence if possible. And, as in this climate it is seldom that the destructive result is by the direct effect, but by the secondary or reactive, such prevention is not unfrequently within our power. Plainly, it is to be accomplished by moderating reaction ; abstracting cold, and yet not applying sudden heat or other stimuli. The common practice is very successful ; and, though perhaps not actually based on scientific principles, can be most satisfactorily explained by them. A part undergoing the freezing process—threatening to die by the direct effect of intense cold—becoming pale, shrunk, and but little sensible, is rubbed with snow ; while the patient and part are yet in the open air, or at least not exposed to sudden elevation of temperature. Rubbing arrests the sedative effect, and induces reaction ; and rubbing with cold ensures the reaction being gradual, slow, and safe. Circulation and nervous influence are restored ; and returning vital power finds no undue excitement to oppose or control.

When gangrene has set in, by reaction proving excessive, our object

is to moderate this ; and at the same time to sustain constitutional power. Applying poultice, water-dressing, pencilling with nitrate of silver, or other soothing applications ; with careful regulation of diet, and administration of suitable remedies internally.

In the chronic gangrene of old people, the *Gangræna senilis*, we may have two varieties, as already shewn ; death direct, from diminished vascular supply ; or death indirect, weakened power being overcome by inflammatory accession. In the former case, cautious general support is expedient by ordinary diet, cautiously regulated and watched ; enough to maintain and increase general power, yet cautious, to avoid the induction of an inflammatory process, which we know the part is unable to bear. The part itself may be covered with tepid-water dressing, or any other bland protective application.

In the second, or inflammatory form—much the more frequent—our object should be to subdue the inflammatory process ; yet without impairing, and on the contrary rather adding to, the general power of system. The best local application with this view, is the nitrate of silver ; pencilled over the red, painful, and swollen parts, so as merely to blacken, and obtain the simply sedative and antiphlogistic result ; covering the part, afterwards, with a light poultice, or water-dressing. The patient should be kept in the recumbent posture, with the part somewhat elevated. The diet must be non-stimulant ; otherwise inflammatory progress, already beyond the power of the part to bear, will be further increased. At the same time, it must not be truly antiphlogistic, or starving ; otherwise, both general and local power, already weak, will be still further impaired ; and the existing inflammatory process, even without increase, will be rendered more and more destructive. It will consist then, of simple farinaceous food, with the weaker forms of soup, or beef-tea—perhaps an egg, or fish. No wine, or other stimulants. The continued use of opiates is highly expedient. Great pain and general irritation attend the progress of the disease. The former is in part alleviated by the nitrate of silver. Both will be much assuaged by opium ; which further, according to some, would seem to exert a beneficial tonic effect on the capillaries ; thereby tending to increase vital power, in circumstances where it is much required. Under such treatment, we expect, and often not in vain, that pain, redness, and swelling, shall cease ; as also the advance of mortification. A healthy line of demarcation is established ; the dead parts are thrown off ; the patient rallies greatly in his system ; and, in short, recovery is obtained, though not of course without more or less mutilation.

But such was not the practice, and such were not the results, of former times. The practitioner took but a one-sided view of the case ; observing deficient power alone, and overlooking the *inflammatio debilis*. His patient was literally crammed with diet, of the most rich and stimulant kind. If in the better ranks of life, his table was made to groan daily, under the most sumptuous viands ; and yet the generous food seemed only to feed the disease. The dusky redness spread more and more ; and both part and frame sank under it. The error was at length perceived ; and an opposite extreme was gone into. Antiphlogistics were plied actively, as if the inflammatory process were of the ordinary sthenic

form ; without regard to the want of power, which did not fail to increase under the neglect. The patient sank, and died. Now, a middle place is wisely selected. We neither stimulate nor reduce the system ; local disease is moderated, while both local and general power is enhanced and maintained ; and the result is more successful.

Local Applications in Mortification.

Local as well as general antiseptics were at one time believed in : of an alcoholic, terebenthinate, or otherwise stimulating nature. If employed previously to the accession of gangrene, with the inflammatory process still in progress, they prove injurious ; by hurrying on that process, already excessive. During progress of gangrene towards sphacelus, all stimulation of the part must still be prejudicial ; for a like reason. When sphacelus is complete, the stimulants, acting on the surrounding living parts, which are undergoing the sthenic inflammatory process for the purpose of effecting detachment, are likely to aggravate this to an injurious extent. As to their effect on the dead parts themselves, it is either nugatory, or the reverse of beneficial. For, however useful spirits of wine or turpentine may be in preserving parts already detached from the system, similar preservation is certainly not what we desiderate during the process of separation. On the contrary, sloughs cannot be too soon removed from the living tissues. Local stimulants, therefore, improperly named antiseptics, are not only useless, but hurtful.

Scarifications were also at one time in vogue ; usually with the view of enabling the antiseptics to prove more effectual. If they merely implicated the dead parts, they were inefficient. If they penetrated these, and reached the living and inflaming stratum beneath, they obviously did harm ; as undue stimulants. Under only two circumstances are incisions likely to prove beneficial in gangrene. First ; when suppuration has freely occurred beneath a separating eschar ; which, being marginally adherent, and itself being incapable of the ulcerative process, induces all the evils of tension and pressure on an acutely enlarging abscess. Incision through the eschar, under such circumstances, will afford much relief ; and it is not unfrequently thus required, in cases of burn. Second ; when by free incision we may remove the cause of gangrenous disaster, past, present, and impending ; as in phlegmonous erysipelas, diffuse suppuration, and infiltration of urine.

During the formation and separation of sloughs, light poultice, or warm-water dressing, are the preferable applications ; soothing, grateful, and protective to the living parts. Often, the latter may be advantageously medicated and modified, by solutions of the chlorurets of lime and soda, by solutions of the permanganate of potash and iron, and by various preparations of charcoal, with the effect of correcting factor, and apparently hastening the healthful cleansing of the parts.

As sloughs become detached, by the undermining process of ulceration in the living stratum, they should be taken away. If necessary, scissors are employed ; cutting with these only in the dead part however. For, in affording assistance to Nature in her detaching efforts, we should occasion neither one moment's pain, nor the loss of a single drop of blood.

Pulling rudely at yet adherent sloughs, or cutting in living parts, is not unlikely to reinduce sloughing ; more especially when gangrene is of the chronic form, and attended with general debility. After separation, both part and system are treated as in ordinary granulation ; only with a foreknowledge that, on account of previous exhaustion, support will be soon demanded on behalf of both.

Question of Amputation.

1. Amputation is not unfrequently advisable, in order to *prevent* the occurrence of gangrene. Thus ; when a limb has been much injured by mechanical or chemical means—in the case of a severe compound fracture, or burn, for example—and it is apparent to the experienced observer that mortification must ensue, involving the whole thickness of the limb, acute, tending to spread, and from the first accompanied by the most formidable constitutional symptoms—amputation is performed above the injured point ; so soon as the primary shock has passed away, and the system rallied so far as to afford sufficient tolerance of the operation.

2. When, after such injuries, gangrene has set in, of the acute and spreading kind, there is, in certain cases, no question as to the propriety of immediate operation. At one time, it was by many considered right, in this and in all other cases of mortification, to wait for the spontaneous line of separation. But delay, under these circumstances, with such an object in view, will in most cases be in vain. The gangrene spreads upwards and upwards, with a diffused and streaky margin ; the typhoid symptoms grow more and more intense ; the trunk is reached, rendering operative interference hopeless ; or, long ere this, the system has sunk, and the patient perished. The only hope of escape is by early amputation. It is a slender chance, no doubt, but it is the only one ; and to it the patient is entitled. While the mortification is as yet undefined, we amputate at some distance from the gangrened part ; in one which is sound, or at least appears to be so. If there be no point distal to the trunk, altogether free from the signs of incipient death, we refrain from the knife ; its use must then prove futile, and would but accelerate the fatal issue. And, in selecting the line of incision, when amputation is advisable, it is well to remember that the subcutaneous tissue is often an earlier victim than the skin itself ; that, therefore, the immediate vicinity of the discoloured margin is never suitable ; and that, in all cases, careful manipulation should be employed, to ascertain, if possible, that all textures, as well as the skin, are yet sound ; otherwise, we might be cutting in parts not only doomed, but dead. In many examples of acute traumatic gangrene, in which there is even much space apparently suitable for amputation, the constitutional depression has already advanced so far as to render the shock of an operation, then performed, certainly fatal. In such circumstances, our attention must be mainly directed to rousing the vital powers ; sustaining them under the depressing agency ; and if, thus aided, they fail in attaining to even a temporary rally, we refrain from operation.

3. In the chronic form of gangrene, arising without apparent external cause, there is no such haste in the use of the knife. Nature's initiative

is calmly awaited. For, until the line of separation has been formed, we cannot know how far the gangrenous seizure has extended. If we amputate during progress, it is not unlikely that we shall be cutting in parts foredoomed. They had not power to resist the *inflammatio debilis*, which was gradually creeping on; and certainly will not, for an instant, withstand the graver amount of inflammatory attack, which such formidable incisions must inevitably produce. And, further; even after the line of separation has occurred, and is duly advancing, it is probable that, local as well as general debility being still great, the parts have just power enough to sustain the spontaneous inflammatory change necessary for the ulcerative process, and would undoubtedly perish under the greater amount induced by the stimulus of incision. Therefore we wait, not only until the line of demarcation has been made, and separation begun; but until the latter has been in a great measure completed; assisting Nature's amputation, rather than operating ourselves; using our knife and saw merely to divide the fibrous and osseous textures, which are slow to ulcerate in this way; injuring the living parts as little as possible; yet sloping the knife upwards, in order to have an opportunity of sawing the bone so high, as to afford a fair prospect of the stump proving sufficiently fleshy and useful.

In such cases, the system is intolerant of loss of blood; and that is another reason why incisions should be so guarded. There is a circumstance, however, attendant on the disease, very favourable in this point of view. The dry, hard, impenetrable sphacelus has the same effect on the arterial tubes, on its cardiac aspect, as a ligature. *Remora* of their circulation is induced; coagulation takes place, and each arterial canal is obstructed, up to the nearest open collateral branch. As the line of separation passes through, the vessels are further and more securely shut up, adhesively; such ulceration being of the sthenic kind, and, as usual, preceded and accompanied by plastic formation. Even supposing, therefore, that our knife does encroach a little on the living parts, higher than the line of spontaneous ulceration, hemorrhage is likely to prove but trifling.

4. In the chronic gangrene which is induced by cold—an obvious external cause, and independent of constitutional vice or failing—we still await the line of demarcation; for, otherwise, we cannot tell how far the fatal amount of local depression has extended. But after separation has been fairly and spontaneously begun, we do not hesitate to amputate; and with the option of either finishing Nature's operation just commenced, or of cutting in a higher and perhaps more suitable locality. For, the debility being only local, temporary, and not dependent on organic change, occurrence of the line of separation is sufficient evidence that in every point of the living parts there is then tolerance of operation. Often a better stump can be fashioned at a higher point than that which Nature has happened to select. But were such amputation to be made previous to arrest of the gangrene, most probably the flaps would speedily slough.

Thus then, when gangrene is acute and humid, dependent on an external cause, and unconnected with a previously existing failure of system, or organic change in the general limb, we amputate, if the general symptoms admit of it, during progress of the disease; without waiting for

a line of demarcation. When it is chronic and dry, dependent on an internal cause only, or on internal more than on external causes, and connected with failure of both general and local power, we wait for the line of demarcation, watch the progress of separation—cautiously supporting the system meanwhile—and when detachment is far advanced, we interfere merely to facilitate and modify its completion ; we amputate in the line of separation. When gangrene is the result of one particular external cause, cold, we await the line of demarcation ; and, so soon as that has been fairly formed, we amputate either there, or above, according as circumstances may seem to require. To these rules there are occasional exceptions. Sometimes, in a spreading acute gangrene, for example, it may be prudent to await the line of demarcation. And sometimes, in chronic gangrene, it may be expedient to amputate independently of this. Such exceptions are only occasional, however ; and, as usual, do not fail to strengthen the general rule.

CHAPTER VI.

HYPERTROPHY, ATROPHY, AND ABSORPTION.

Hypertrophy.

THIS is simply an excess of *growth* in the part, whereby, while its normal structure is enlarged, its functional activity is also enhanced. Unconnected with the inflammatory process, it is most frequently the consequence of unusual and sustained functional exertion. The walls of the heart, for example, labouring to propel the blood through contracted channels of exit, become thus affected ; and similar change on the muscular coat of the bladder invariably follows the straining attendant on stricture of the urethra.

Arrest of the change can be obtained only by removal of the cause ; and diminution of the bulk may be helped, when the part affected happens to be external, by pressure and friction.

Atrophy.

Atrophy of a part may occur in two ways ; from excess of waste, or from deficiency of supply. In most cases, it is probable that both circumstances concur to establish the result. The part is gradually diminished in bulk, and its function is more or less deranged.

Atrophy, *with degeneration*, implies not only diminution of bulk, but more or less change of structure in the part ; the ordinary texture disappearing, and fatty, fibrous, or calcareous matter occupying its room. The first named is the most frequent variety of change.

Atrophy may follow on the inflammatory process ; as a remote consequence, not as a direct result. The connection is usually with the chronic form. That affection ceasing, absorption busies itself to remove the loaded change of structure ; and this exaltation of function may be continued beyond what was necessary to restore the healthful balance. Besides, that disuse of the part which attends on chronic inflammatory disease will necessarily have the effect of diminishing the arterial circulation ; and this latter cause of wasting may be further contributed to by a remaining change of structure in the part itself. Or any of these causes may of themselves be equal to the result. Thus, a testicle, which has been simply inflamed, may become simply atrophied ; a limb which has been long disused, on account of inflammatory disease of a joint, or from any other cause, invariably is more or less wasted ; granular disease of the kidney is accompanied or followed by decrease in the bulk of that organ.

Treatment.—The indications are simple. To obviate the cause or

causes—resuming use of the part, improving the condition of the blood, and applying stimulus locally, as by friction or galvanism. Sometimes slight counter-irritation seems to be of service.

Absorption.

By absorption is meant a wasting of a part by removal of its structure, through excess of corpuscular moulting or decay; the process gradual, comparatively painless, and non-inflammatory; differing from ulceration

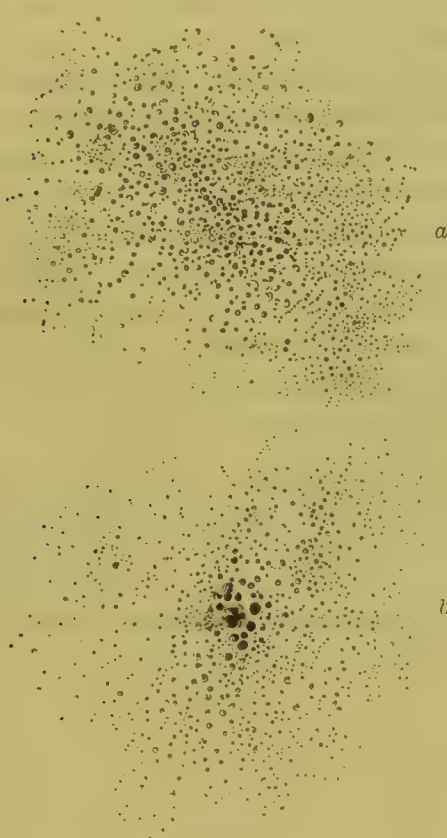


Fig. 39.

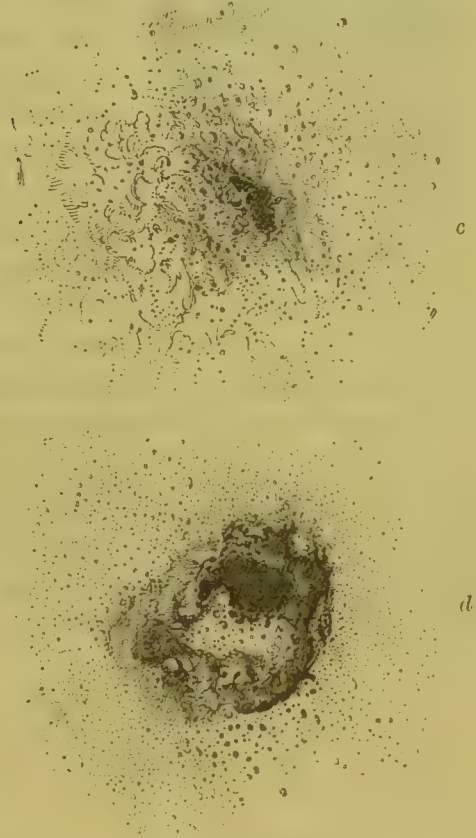


Fig. 40.

in the absence of discharge, the waste matter being received back directly into the blood. Absorption may take place at an indefinite number of points in a tissue, or it may advance in a regular and unbroken line; in the former case it is *interstitial*, in the latter *continuous*.

Interstitial Absorption is most frequently observed in bone; converting what was dense into cancellated texture. Or, the change being limited to certain points, interspaces of normal tissue remain; the whole having a worm-eaten appearance (Fig. 39). The super-imposed soft textures are usually in a state of passive congestion. The part is slightly swollen, puffy, and darkly discoloured; there is a deeply-seated uneasiness,

Fig. 39. Interstitial absorption in progress, in the cranium; at *a*, just begun; at *b*, more advanced. It may stop here; producing a merely cancellous state of the tissue; or it may advance, becoming merged in ulceration, and producing caries, as in Fig. 40.

Fig. 40. Different portions of the same skull as Fig. 39; at *c*, ulceration established, surrounded by interstitial absorption; at *d*, caries, with necrosis, in the centre—interstitial absorption still accompanying.

rather than pain, aggravated by pressure and exercise. The affection is most likely to occur in those of weak frame, and is usually attributed to external injury. The treatment consists in gentle counter-irritation, rest of the affected part, and attention to the general health.



Fig. 41.

This morbid state of bone is found to be of importance, not so much on its own account, as in consequence of its being the precursor and accompaniment of one of the most troublesome diseases with which our art has to contend—caries (Fig. 40).

Continuous Absorption differs from the preceding in being continuous, instead of interstitial or interrupted, occasioning continuous loss of substance.

Familiar examples are afforded by the gradual disappearance of texture, both hard and soft, before slowly increasing pressure; as in the case of aneurism. And pressure

may be considered as the most frequent exciting cause.

Treatment consists in abstraction of the cause.

Fig. 41. Continuous absorption illustrated by the pressure of an aortic aneurism on the bodies of the vertebrae; *a*, the arch of the aorta; *b*, the descending aorta; *c*, the vertebral column. Opposite *d*, the bodies of the vertebrae are seen excavated, with corresponding processes of the compressing clot; while the intervertebral substances, successfully resisting the pressure, project into corresponding depressions of the fibrin.

CHAPTER VII.

TUMOURS.

PERVERTED nutrition has already occupied our attention, as a result of the inflammatory process. Under the present section, we have an example of perverted nutrition of a different kind, constituting Tumour ; a morbid growth, or new structure, of slow and gradual progress, possessed of a formation and increase distinct from those of the original tissues, and dependent on these for little more than their vascular supply.

Tumours have been called *Analogous* or *Homœomorphous*, when their structure is of a kind resembling some normal texture ; as fat, fibrous tissue, cartilage, bone—*Heterologous* or *Heteromorphous*, when they bear no similitude to the normal tissues ; as scirrhus and melanosis. To the morbid anatomist it is evident that some such classification is desirable—according to his knowledge of morbid structures, derived from minute and careful examination of their characters in the dead body, or after removal from the living. The practical surgeon, however, is under the necessity of looking for a classification, the elements of which are more within his grasp, and which can be serviceable to him ere yet the tumour has been subjected to his operations, or in any way interfered with. Such a classification has existed, in one form or other, from the most ancient periods ; some tumours being universally recognised as of peculiar danger in whatever part they occur, from their connection with an evidently constitutional affection, their tendency to recurrence after removal, and their irresistibly progressive and destructive march ; hence called “*tumores mali moris*,” or *Malignant*. On the other hand, tumours not presenting these characters are considered as *Simple*, *Benign*, or *Non-malignant* ; and although the classification founded on this distinction may, like all others, still prove arbitrary, and its application to some varieties of tumour involve not a few controverted questions, yet it is on the whole the most significant and practically important division which has been yet established.

Non-malignant Growths are such as are not diffusely infiltrated into the adjacent textures, and do not consume these by involving them in the same degenerated structure with themselves, but simply push them aside, usually condensing a portion into the form of an enveloping and limiting cyst or capsule ; proving injurious chiefly by bulk and position ; having no tendency to reproduction when thoroughly removed, and being unconnected with constitutional cachexy. *Malignant tumours*, on the other hand, efface the normal texture of the part in which they form, and ever seek their own extension by further change of surrounding textures into resemblance of themselves ; they are connected with constitutional disorder ; their bulk is not so injurious as the pain, hectic, and exhaustion which attend on their advancement ; when removed, there is no

guarantee that they shall not be reproduced, in the same or another site ; in one sense they are not themselves a local disease, but rather the local indications of a disease which has a constitutional seat and origin. Of the simple or non-malignant tumours, take the adipose or the fibrous as examples ; of the malignant, the scirrhus or the medullary.

With respect to structure, malignant tumours are in general heterologous, differing essentially from all the known tissues of the body ; while the non-malignant are more commonly analogous, or similar to some of these tissues. The latter may present the appearance of fibrous tissue, fat, cartilage, bone, blood-vessels, etc. ; and the different varieties of non-malignant tumours are in fact designated from the tissue which they resemble. On the other hand, the truly malignant growths, while presenting considerable varieties, have also general resemblances to each other, so strong as to entitle them, in the opinion of the best observers, to be considered as varieties of one disease, and as depending on the constitutional affection ordinarily described as *Cancer*.

As a middle class between the Simple and Malignant tumours, may be placed what are ordinarily termed the *Recurrents*, as first named by Mr. Syme, and specially described by Mr. Paget, Dr. Bennett, and others ; growths apparently simple in their characters, both natural and microscopic, but which nevertheless are prone to recur even after complete removal.

The great majority of tumours are enveloped by a *cyst*. In some—those commonly called Encysted—it is the original and essential part of the structure ; by secretion from which the contents of the tumour are produced ; and in extirpation the whole of this cyst must be either removed or destroyed, otherwise reproduction is certain. In others, as the adipose, the cyst, or capsule—as perhaps it might be more properly called—is constituted secondarily, and consists merely of ordinary areolar tissue condensed into a membranous appearance by the pressure of the enlarging tumour ; it adheres loosely to the growth, and is to be regarded as no part of its structure ; and when the tumour is removed, this cyst or capsule may remain, without any chance of reproduction. Certain tumours of a suspicious character, and yet not of avowed malignancy—as some examples of the cystic sarcoma—are enveloped in a stout cyst which is truly part of their structure, having become secondarily, if not originally, incorporated with it ; and this cyst must be taken wholly away, if we wish the operation to be satisfactory and complete. The malignant tumours usually are limited by no cyst ; it is their nature to invade and involve neighbouring texture, not to condense and push it aside. Sometimes, however, a fibrous expansion for a time resists the invasion, and, while so successful, assumes the place and character of an ordinary cyst. That too, in extirpation, must be taken away, even though as yet not fully incorporated with the diseased structure.

Some tumours, though homologous and non-malignant, have no limiting capsule, but are continuous with the primary structures from which they spring ; growths *of* rather than *in* them. Such often receive the distinctive term of *outgrowth* ; and familiar examples are found in polypi of the mucous surface, and fibrous growths from the walls of the womb.

In regard to the *degeneration* of tumours, or their transition from the simple to the malignant type, there is a difference of opinion among surgeons ; some holding this to be impossible. I cannot resist the conviction that it does occur. I have observed cases in which tumours, originally simple, have become malignant ; fatty, erectile, and cystic growths have become medullary or melanotic. Again, I have found tumours, excised and bisected, consisting partly of non-malignant and partly of medullary structure ; as if caught in the very act of degeneracy. Tumours, too, are found half scirrhus, and half medullary ; the hard scirrhus passing apparently into the soft cephaloma. Enchondroma, though seldom, yet has been observed softening and becoming medullary (to all appearance) in its centre. And osteosarcoma, I am very sure, sometimes passes into osteocephaloma. Simple ulcers, we know, not seldom become cancerous ; and why may not tumours do the same ?

Perhaps, with some, the question is mainly one of terms. They will not admit that a simple tumour, such as the fatty, passes into a cancerous structure—that the adipose tissue, for example, evolves by change of development its own metamorphosis ; but they may consent to believe that the tumour originally simple may *somehow* have become of malignant structure and tendency. For surely cancerous development may occur in a morbid and adventitious structure, at least as readily as in texture which is normal and primary ; and whatever the recipient structure may be, the morbid development will very speedily convert it into the amorphous and malignant mass. The thing contended for here is not the explanation of the occurrence, but the fact.

Degeneration may proceed from one or two causes ; general or local. While a tumour is yet simple, the constitution may undergo an untoward change, cachexy becoming established ; and the tumour is likely then to sustain a corresponding alteration. Under such circumstances a tumour of the breast, originally of a non-malignant nature, may insensibly assume the carcinomatous structure and tendency ; the signs of degeneracy in the system preceding those of the evil in the part. Or, on the other hand, the system yet remaining apparently unchanged, the tumour itself degenerates, in consequence of repeated local excitement ; as by blow, puncture, or stimulant malapraxis. The tumour's structure, like other organised textures, whether original or secondary, is liable to assume the inflammatory process. When assumed, it may advance to the ordinary results. A recent simple tumour may suppurate, and disappear by disintegration. A circumscribed tumour of any kind, sometimes, though rarely, is reduced to the condition of a slough, and may so be extruded, as it were by Nature's own operation. Ulceration is an extremely frequent result, in any excited tumour, and more especially in those of malignancy. These are clearly the results of the inflammatory process, of a high grade, in tumours. The more chronic and minor process is less marked in its operation, but may be equally decided and even more untoward in its effect. For it seems not unreasonable to suppose that to such morbid condition the act of degeneracy may in large measure be attributed. At first, it may cause mere acceleration of the growth, by increase of the same formation as before ; the tumour enlarges, but is yet of its original simplicity of structure. But after

a time, the formation changes ; the morbid process is altered too ; and the nutrition is not merely exalted, but perverted. The tumour then increases, perhaps more rapidly than before ; but there is more than mere increase, there is degeneracy to boot ; the simple passes rapidly, and with marked indications, into the malignant form. All tumours are liable so to change ; but some more than others. Of the simple tumours, the cystic may be considered the most disposed to evil ; while the fibrous evinces the least tendency to depart from its original nature. The exciting cause of change, when of the local kind, may be accidental injury ; but much more frequently it is the repeated and ill-advised application of stimulus, wilfully, in the vain hope of discussing, by absorption, what is not amenable to such mode of removal.

Certain tumours may be made to disappear by *absorption* ; and to these the cautious application of stimulus, with that end in view, is a commendable and safe procedure ; but, unfortunately, these constitute but a small minority of true tumours. The simple glandular tumour may be discussed ; and so may some recent examples of the fibro-cellular. But all others resist discussion, and can be removed only by the knife. If the attempt to discuss be persevered in, nothing but evil results. 1. Their growth is accelerated. That is of itself an evil. The simple tumour, as such, proves injurious chiefly by its bulk and position ; by accelerated growth that injury is obviously enhanced. At first the tumour, when small, could be removed by operation, with ease and safety ; but, in consequence of the increased bulk, deeper and wider incisions become necessary, important parts are encroached on, and the operative procedure becomes one of difficulty and danger. 2. Adhesions are rendered more numerous and firm. A fatty tumour, for example, uninterfered with, long remains very loosely connected with its delicate investing capsule, even when of large size ; but after repeated stimulation the adhesions become so dense and general, as almost to incorporate the capsule with the tumour. At first, little more than a mere incision might have sufficed ; afterwards a painful, tedious, and careful dissection is required. Many a tumour has thus been not only brought into contact with important parts, but also rendered firmly adherent to them. 3. Degeneration is favoured ; nay, not merely favoured but directly produced, by the malapraxis, while neither tumour nor system had previously any disposition towards such untoward change.

Not unfrequently, however, discussive treatment may be applied with the best success, not as itself a means of cure, but as an adjuvant and preliminary to operation. Thus, a malignant tumour may be of such enormous apparent dimensions as to render extirpation a proceeding of much danger, if not impossible ; and had we no means of diminishing the bulk, and consequently limiting incision, we might be compelled to leave the patient a helpless victim of the disease. But we know that, in most cases, much of the bulk is not really due to the tumour itself, but consists of the common products of the inflammatory process in the areolar and other tissues exterior to it. By discussives, judiciously employed, that outer swelling may be absorbed ; and the mass, then reduced to almost half its former size, may be dealt with by operation fearlessly. Let not the discussives, however, be persevered with or pushed so far as

to attack the tumour itself; otherwise its morbid nutrition is excited, and the result is the opposite of that which we desire.

All tumours sympathise with excitement of the general system, and have their nutritive action proportionally augmented; as during febrile accessions, sustained violent exercise, mental emotion, and occurrence of the menstrual period.

From what has been said, it follows, that long delay in actively treating a true tumour—that is, by extirpation—is seldom expedient. Unless it be of the simplest kind, it cannot be removed by absorption; meanwhile it is, though perhaps slowly, steadily enlarging, acquiring deeper and more important relations, and forming new and more intimate connections; besides, it is every day liable to have commenced in it the process of transition into a structure and tendency of a more sinister kind. If the system be in evident disorder, if the part be in a state of temporary and accidental excitement, or if the bulk be great and not wholly dependent on the tumour—delay is advisable, until correction have been made so far as circumstances will permit. But this having been achieved, means suitable for efficient removal cannot be too soon adopted.

Spontaneous cure sometimes occurs. 1. By absorption. We have already seen in what cases this mode of disappearance may be effected by art; it sometimes, but rarely, occurs spontaneously. 2. By suppuration and ulceration. A simple tumour may inflame; and, suppurating to the core, may crumble down by disintegration; or ulceration may commence on the surface, and gradually extend to the interior; the parts subsequently healing by a depressed and tight cicatrix. By the same process, it will be seen, an erectile tumour may disappear, partly by loss of substance, partly by condensation of what remains. 3. By sloughing. Any circumscribed tumour may be so extruded. Not by inflammatory process within the tumour itself; but in consequence of diffuse purulent formation having taken place in the surrounding areolar tissue, whereby that tissue is destroyed. The tumour, deprived on all sides of its vital supply, rolls out, an inanimate mass.

Tumours are found to vary as to the power and probability of *reproduction*. Some have no such tendency. The simple tumours, taken wholly away by operation, are seldom if ever reproduced in the same site. Some may have even a part left behind, and yet fail to grow again; a glandular or an adipose tumour has sometimes been but partially removed, yet the cicatrix has become firm and permanent, and no subsequent increase has occurred. As a general rule, however, it is well to hold, that in even the simplest formations the whole of the morbid structure must be taken away; so as to render it certain that reproduction shall not ensue. In all malignant growths that rule is most imperative; the slightest fragment of the morbid structure, remaining, is sure to become the root from which a fresh formation will speedily arise.

Examples of tumour occasionally present themselves, differing from any of the types usually described. It is impossible to construct a *classification* which shall embrace every growth. We attempt only that which may include the majority; arranging them, also, in a form at once convenient for description, and suitable for enforcement of the practical details of treatment.

Tumours are *Solid*; consisting of a more or less compact fleshy growth, whose enveloping cyst or capsule is entirely of secondary formation. Or they are hollow—*Encysted*; the cyst the original structure, and its secretive power maintaining the bulk and increase of the morbid growth.

The solid tumours, again, are *Simple* and *Malignant*. In the former class are the *Glandular*, the *Fibro-cellular*, the *Fatty*, the *Fibrous*, the *Cartilaginous*, the *Osseous*, the *Calcareous*, the *Myeloid*, the *Vascular*. The *Malignant* are the different varieties of Cancer—*Scirrhus*, *Epithelioma*, *Medullary Tumour*, *Fungus Hæmatodes*, *Colloid Cancer*, and *Melanosis*.

The hollow, or encysted tumours, are usually non-malignant; composed of mere cysts, either simple or proliferous. Tumours containing cysts imbedded in a solid stroma may be more properly included among the solid formations, their fleshy portion being the part of the structure which determines their original character.

I. *Solid Tumours, non-malignant.*

1. THE GLANDULAR TUMOUR.—There is reason to think that many of the tumours included under the “common vascular sarcoma” of Abernethy, are little else than abnormal increase and alteration of structure in a gland, the original characters of which become more or less

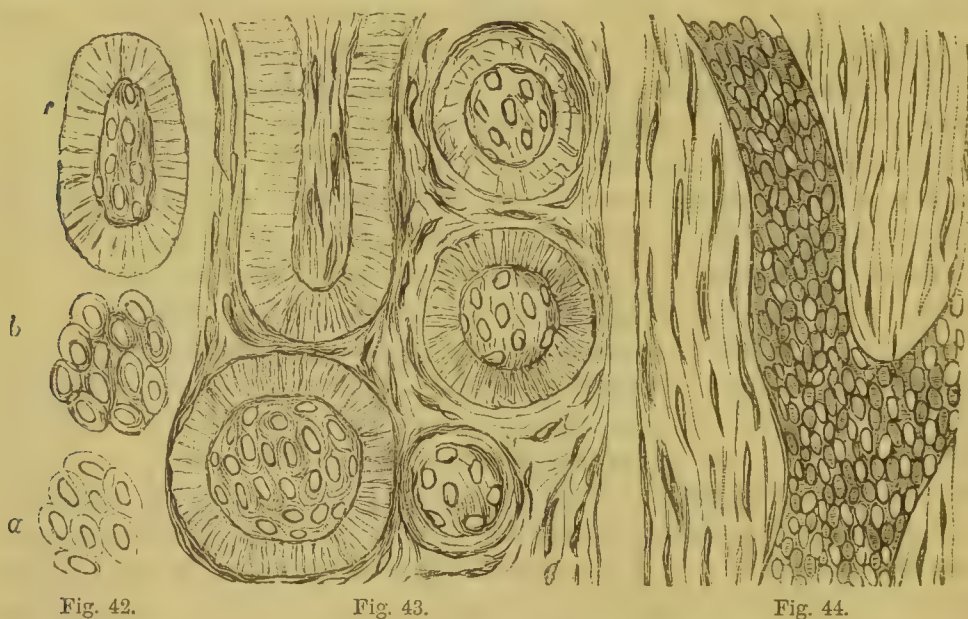


Fig. 42.

Fig. 43.

Fig. 44.

completely lost to the naked eye, although they may be recognised by the microscope. Many of the simple tumours of the mammary gland, or

This series of diagrams represents microscopic sections of a simple tumour removed by operation from the female breast; consisting mainly of hypertrophy of the fibrous structure of the gland, with enlargement of the included ducts and their epithelial linings.

Fig. 42. *c*, Section of the epithelium from one of the tubes. *b*, Group of epithelial cells from the same. *a*, The same after the addition of acetic acid.

Fig. 43. Thin section of the same tumour, after the addition of acetic acid.

Fig. 44. Another section transverse to the former, similarly treated.—BENNETT.

chronic mammary tumours of Sir A. Cooper, are of this character. And so are many growths in the thyroid and parotid glands. Similar tumours however are found, not as mere enlargements of existing glandular structure, whether lymphatic, vascular, or secretory; but altogether separate and distinct from such primary texture—new formations.

Their growth is slow and painless; lobular often; firm but not hard, and somewhat elastic; they are loosely connected to the surrounding parts by a delicate cyst or capsule, through which they are sparingly supplied with blood-vessels. “On section they commonly appear lobed, or intersected with partitions of connective tissue, and are pale, grayish—or yellowish white; in some specimens looking translucent and glistening, in others opaque; in nearly all acinous or glandular” (Paget). Sometimes small cavities are found, filled with serous fluid. The microscopic structure imitates, in its essential features, that of the glands in or near which they are severally found; but is often rudimental, or imperfect, or degenerate.

Treatment.—This is one of the few tumours which may not only be retarded in its growth, but even made to disappear by absorption—as by pressure, friction, and suitable constitutional means. And for this reason, mainly, it is here placed first in the classification. Failing absorption, recourse is had to the knife.

2. The “*Fibro-cellular*” tumour of Paget, the “Simple Tumour” of others, is composed mainly of tissue closely resembling the ordinary areolar, usually more or less embryonic or imperfect. As an out-growth it may form in connection with mucous membrane—a polypus; in connection with the skin—a pendulous tumour.

The site of this formation may be either deep or superficial. Its growth is slow and painless. The bulk is extremely various. Firm, yet somewhat elastic to the touch, like the preceding, it is usually oval or round, and often lobular.

Exposed by incision, it is found loosely connected to the surrounding parts by a delicate capsule of areolar tissue. On section it “usually presents a shining, pale yellowish, or serous-coloured basis, intersected by opaque white bands, moderately firm, succulent, and highly elastic” (Paget).

Treatment.—It is just possible that some of these tumours, as in the case of the preceding variety, are capable of being removed by discussion, while yet recent, and scarcely removed from their first or nascent stage. The part is to be placed and kept in a state of repose. By moderate but repeated leeching from the vicinity of the part, the morbid nutritive process is sought to be stayed; and then, by counter-irritation, and stimulation of absorption, gradual retrocession is patiently expected. Gentle blistering may be employed; or iodine, in the form of ointment or solution; or mercury, in ointment; or pressure; or plasters of galbanum, ammoniac, mercury, or other discutients. At the same time, the state of the general health should be seen to; and iodine may be administered internally. The local stimulation is proceeded with warily, lest excess ensue, and the tumour grow more rapidly than before.

When the means above mentioned have been tried and failed, extirpation by the knife is to be had recourse to, at a yet early period; before

any great size has been attained ; when the morbid structure is yet loosely connected with the surrounding parts ; when no deep-seated and important vessels, nerves, cavities, or canals, are yet in close contact ; and ere opportunity has been afforded for degeneration.

3. THE FIBROUS TUMOUR.—A great variety of tumours might with propriety be termed fibrous ; in fact fibrous tissue is an element of almost

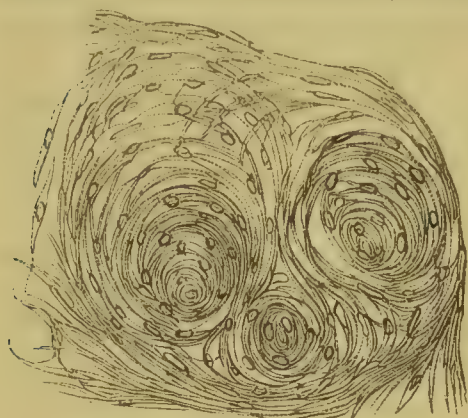


Fig. 45.

all growths ; and many of them are entirely composed of it, constituting a mass of interwoven glistening white fibres, of a most characteristic appearance. Sometimes, however, the section is pale and dense, without any fibrous appearance to the unaided eye.

Fibrous tumours are common in the uterus, where they may attain the size of an adult head. There, too, they often present the character of out-growths, as well as in the nose and

pharynx—the firm, fibrous polypus.

The tumours are sometimes called *Desmoid*, from the resemblance of their fibres to those of ligament (*δεσμος*) ; to the structure of which indeed they approximate very closely, whether viewed by the unaided eye or by the microscope. The fibres are rendered more or less transparent by acetic acid, at the same time swelling up and revealing nuclei, which are sometimes oval, and sometimes elongated. Not unfrequently, in the midst of the fibres are found small extravasations of blood, the origin of which is not well understood, as the vascularity of these tumours is very inconsiderable—except when undergoing the inflammatory process, and then they may become copiously supplied with blood. By protracted boiling, fibrous tumours are almost entirely resolved into gelatine.

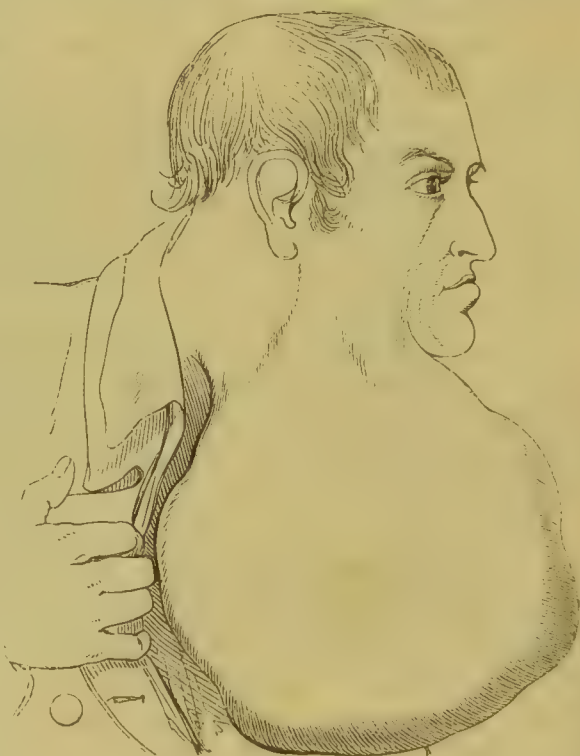


Fig. 46.

There are varieties. In the uterus, and elsewhere, they may contain earthy matter, even to a considerable extent ; or the fibrous tissue may be mixed up with muscular ; not unfrequently, also, the section may present

Fig. 45. Section of a desmoid fibrous tumour from the uterus after the addition of acetic acid, shewing the nuclei of the connective tissue corpuscles.—BENNETT.

Fig. 46. Large fibrous tumour growing from the neck. Was successfully removed.

a certain amount of cartilage (the *chondroid* tumour of Müller) or of bone. And in those which occupy a subcutaneous site, elastic fibres are not uncommon. Sometimes cysts are formed; the contents various. The last variety constitutes the common form of "*Cystic Sarcoma*," cysts, simple or proliferous, filled with innocent product; the stroma fibrous.

The diagnosis of fibrous tumours is ordinarily not attended with much difficulty. They are the most dense and firm of all simple tumours of the soft parts. Their shape is irregularly globular, seldom lobed, but their surface frequently nodulated. The investing capsule is sometimes tolerably compact, presenting a smooth surface to the tumour, with which it is slightly connected. They are perfectly circumscribed, movable, and independent of the tissue in which they appear—outgrowths excepted. They may occur in any situation. They are frequently found in the neck, in the vicinity of the mammary and parotid glands, and connected with the uterus. They are common, too, in bone, in nerve-tissue, and in connection with sheaths of tendon. They are painless, slower in growth than any other tumour, and the least liable to change in structure or tendency. They are consequently inconvenient mainly by their bulk; and by the uneasy sensations, and interruption to function, which their compression of neighbouring parts may occasion.

When superficial, and of large size, the inflammatory process may cause softening of the structure, with increased growth, and ulceration of the skin; hemorrhage taking place more or less copiously.

It has been asserted that the fibrous tumour never degenerates; and that, therefore, as it is of slow growth, it need not be made the subject of operation, early, or at all. This, however, seems to be an exaggeration of the fact. It is slow of growth as a fibrous tumour, and is little prone to abandon that character; but age of the patient, and accidents of the system, duration of the tumour, and its frequent injury or stimulation, may lead even the fibrous structure into degeneracy, with rapidity of untoward advancement. Let extirpation be had recourse to, then, while the tumour is yet small, simple, and free. No hope need be entertained of absorption. When circumscribed the mass is removed alone, by simple dissection from its capsule. When it is incorporated with primary structure, as in connection with bone or nerve, a certain amount of this must at the same time be sacrificed.

4. FATTY TUMOURS.—Fatty matter occurs in morbid growths in several microscopic forms; of which the chief are, 1st. Crystals, laminated, or radiated and acicular (the former being cholesterin, the latter margarin). 2d. Molecules, granules, and globules, which are of very frequent occurrence in almost all morbid structures, and are chemically composed of olein holding margarin in solution, and accompanied by more or less albuminous matter. 3d. Disposed in distinct cells, like those of normal adipose tissue. The first two forms here mentioned are peculiar to no special kind of tumour; occurring in both simple and malignant formations; and found in great abundance in encysted growths, where the fatty matter is entirely extra-vascular and undergoes no further organization. A form of tumour of not very common occurrence, and described by Müller under the name of Cholesteatoma, consists of fatty matter, chiefly in the first two forms, and also contained in very thin imperfectly-organised cells.

The substance thus formed is of the consistence of tallow, and is deposited in successive layers in the interior of a thin cyst, forming a laminated mass, having a lustre like mother-of-pearl, and entirely without vessels.

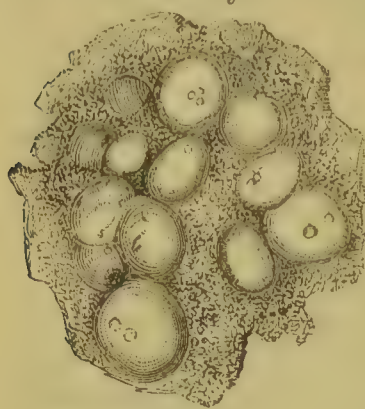


Fig. 47.

Fatty hypertrophies or out-growths are not uncommon, subcutaneously. The "double chin," and the "hump" on the nape of the neck, are familiar examples. They are chiefly inconvenient through bulk and deformity. In the neck, however, there is sometimes pain. Arrest and diminution of growth may sometimes be obtained, by pressure, friction, and the external use of iodine. Some place faith in the internal administration of liquor potassae.

Fatty tumours are of two kinds. In one the fat is firmer than the normal tissue, and compactly disposed in dense interlacements of areolar tissue. The swelling is usually oval and smooth; and the surface is apt to be rather firmly connected with its investing capsule. The site may be either superficial or deep—more frequently the latter.

The other and more common variety—usually subcutaneous—in structure differs not at all from normal adipose tissue. The tumour is always lobulated, often in all its aspects, and irregular in form; flat, globular cylindrical, according to circumstances. The sensation imparted to touch is one of elasticity, closely simulating fluctuation, and requiring the *tactus eruditus* to solve the difficulty. Manipulation is quite painless: the integument, if not hypertrophied, is pale, slack, and freely movable on the tumour; and this, too, is loose upon the parts beneath, at least in the first instance. The investing capsule is delicate and fine; the supply of blood-vessels scanty. When, however



Fig. 48.

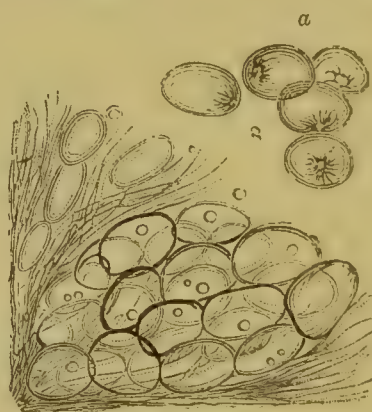


Fig. 49.

the growth has been of long duration, and attained to great size, both skin and tumour may become more fixed, the former being stretched over, and partly incorporated with, the bulky mass; and the latter

Fig. 47. Fat cells and granular matter, from a steatomatous tumour of the ovary.—BENNETT.

Fig. 48. Fatty tumour, removed from a cyst under the tongue. It was as large as an orange.

Fig. 49. Structure of a fatty tumour removed from the back. *a*, Isolated cells shewing crystalline nucleus of margaric acid.—BENNETT.

having sent forth its lobules deeply into the intermuscular spaces. Growth is gradual and steady ; more rapid than that of any other simple tumour, yet slower than that of any malignant swelling for which it is likely to be mistaken. The most common sites are the thighs, shoulders, neck, back, abdominal parietes, and labia pudenda. Sometimes the tumour is of a pedunculated character, projecting from the general surface, and attached by a narrow neck.

The swelling for which it is most apt to be mistaken, is abscess. Tactile examination usually suffices for the experienced. Besides, there is the history of the case ; all signs of inflammatory excitement are absent, during its progress ; the skin is pale and loose ; there is no œdematous swelling around, unless the size of the tumour should interfere with lymphatic return : and this it seldom does, usually occurring on the outside of the limbs.

The structure may undergo change, in a variety of ways ; through long duration, the application of pressure, or other causes. The fatty matter may diminish by absorption, while the areolar tissue becomes thickened and enlarged, giving to portions of the mass a fibrous appearance ; or earthy patches may be found on section ; and softening, or even suppuration, may take place at some points, though rarely.

It is vain to attempt discussion of this tumour ; nothing but harm can ensue ; enlargement, adhesion, degeneration. A seton has been used ; in the hope of exciting disintegration by thorough suppuration. But the result will prove unsatisfactory ; and besides, the procedure is fully as severe as the appropriate treatment—extirpation. This should not be long delayed ; for although the fatty is among the most simple of tumours, and little prone to change in either structure or tendency, yet examples are not wanting of stimulation, long continued, having been followed by medullary and malignant degeneration. That is to say, a tumour originally fatty may, after some years' subjection to pressure and irritation, change its external characters and mode of growth ; presenting, on its ultimate removal, the usual appearances of medullary formation. The possibility of this is denied. But what the eyes have seen and the hands felt, the tongue cannot refuse to acknowledge.

Besides, the lobules are apt to extend deeply, as already stated ; and, without any degeneracy of structure, an operation may thus be rendered difficult and dangerous. It is good surgery to advise and execute extirpation by the knife, so soon as we are satisfied of the existence of such a tumour, and the patient has been convinced of the expediency of the operation. A free incision having been made through the integuments and capsule, the elastic swelling starts outwards ; and no regular dissec-

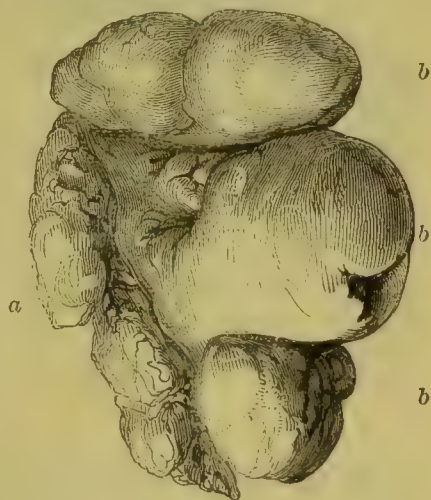


Fig. 50.

Fig. 50. Fatty tumour, lobulated. *a*. The superficial part ; at *b*, the lobuli, which burrowed deeply.

tion is required as in other tumours ; the fingers, aided by an occasional touch of the knife, to liberate the lobules from the pouches in which they are developed, usually sufficing for removal.

5. THE CARTILAGINOUS TUMOUR, or ENCHONDROMA, usually occurs in connection with bones ; but cartilage is also found, though more rarely, in tumours of the soft parts, as of the parotid, testicle, etc.

They are slow and painless in growth, roundish in form, oftener nodulated than lobed ; they are firm to the touch, though sometimes obscurely elastic ; and are connected to the surrounding parts by a tough capsule of condensed fibrous tissue. Generally the tumour is single ; yet not seldom they occur in numbers, especially on the hands and wrists.

Section discloses cartilaginous matter usually of foetal character—"bluish, or yellowish white, smooth and glistening, close, uniform, without appearance of granular or fibrous texture" (PAGET)—disposed as a continuous mass, or, more frequently, arranged in small round masses, with intersections of connective tissue. Sometimes portions are found simply softened, sometimes containing a proportion of fibrous matter, sometimes ossified.

The microscopic characters resemble those of ordinary transitional or ossifying cartilage.

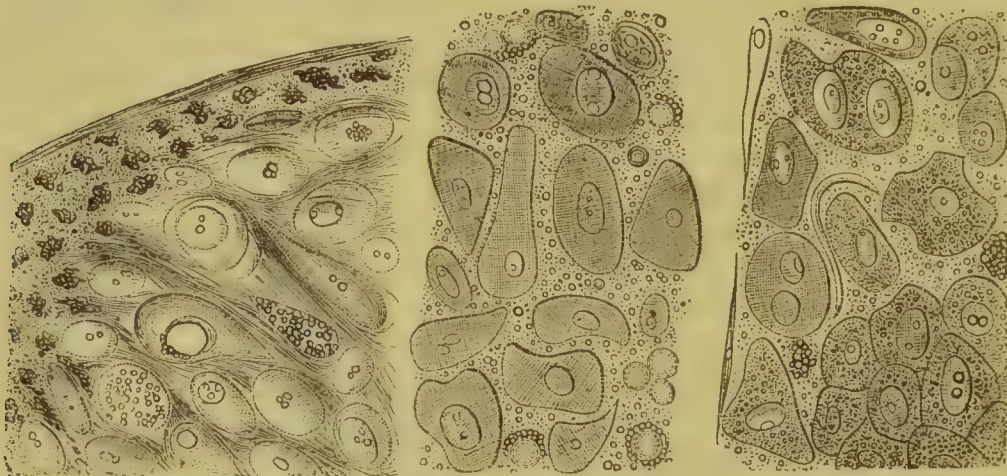


Fig. 51.

Fig. 52.

Fig. 53.

When the tumour is of large size and superficial, the skin may ulcerate and hemorrhage occur ; but the blood usually comes from the subcutaneous veins implicated in the ulceration, not from the mass itself. The inflammatory process may soften and disorganise the interior. And sometimes, though very rarely, malignant medullary degeneration is said to have been observed.

There is but one treatment for such formations ; early removal by the knife.

6. THE CALCAREOUS TUMOUR, comparatively rare, is most frequently found in the face and neck—especially in the former situation, in the vicinity of the parotid gland. In most cases, the stroma of the earthy deposit would seem to be the hypertrophied texture of a lymphatic

Fig. 51. Thin section of the circumference of an enchondroma from the pelvis.

Fig. 52. Corpuscles from the softened part of the same tumour.

Fig. 53. The same after the addition of acetic acid.—BENNETT.

gland. The tumour is superficial, loose, painless, hard, of slow growth and small size; its surface generally unequal. It has no tendency to degenerate; being in fact but a mass of unorganized matter. Absorption, however, is hopeless; and removal may become expedient on account of the inconveniences attending its position. From the circumscribed form, small size, and slighthness of adhesion, the dissection is easy; little more than simple incision is required.

Calcareous formations are also found in the ovary, in the testicle, in congenital encysted tumours, and in the lung. And in the fibrous tumour earthy matter sometimes supplants portions of its characteristic tissue.

7. OSSEOUS TUMOURS are most commonly found in connection with bone, but sometimes form in considerable numbers in fibrous structures, either normal or adventitious. They also occur in enchondroma. Or rather, the enchondroma, by ordinary transition, becomes developed into the osseous.

The structure of such tumours closely resembles that of ordinary bone. And they present two varieties; the *dense*, shewing a section like the laminated portion of the centre of the femur, and most common in flat bones; the *open* or *cancellated*, shewing cancelli with marrow, in the interior of thin laminae, and ordinarily found on the shafts of the long bones. The subject will be more fully discussed in connection with Diseases of Bone.

8. THE MYELOID TUMOUR, under the microscope, is seen to be "chiefly composed of minute structures similar to those of foetal marrow or diplöe" (PAGET); although to the unaided eye there is no such resemblance. On the contrary, the tumour is firm and somewhat elastic; the section shewing a "uniform grayish or yellowish shining substance, blotched or suffused with deep crimson, or pink, or blood colour, but not, apparently, from the presence of blood in the part." Sometimes the texture is permeated by spicula or bars of bone—constituting one of the varieties of osteosarcoma. Sometimes, on the contrary, the texture is here and there softened and almost liquefied. Sometimes there are cysts.

They are lowly vascular, and grow slowly. Their ordinary site is in connection with the bones.

Though non-malignant primarily and essentially, that they may and do degenerate I make little doubt. They are amenable to but one mode of treatment—extirpation.

9. THE VASCULAR TUMOUR.—This, involving three varieties—the capillary, arterial, and venous, according as these different tissues happen to be mainly involved—will be considered in a future chapter, along with the other diseases of blood-vessels.

II. *Hollow Tumours, Non-Malignant.*

Ordinarily cysts are divided into two kinds—the *Simple* and the *Proliferous*; or those which do or do not possess the power of producing organised structure.

It is generally believed that they may be produced in one of three ways:—1, By the enlargement of elementary cells into sacculi with power of secretion; 2, by the enlargement of natural ducts or sacculi, such as

the mucous or sebaceous ; 3, by enlargement of the interspaces of primary connective tissue, with strengthening and condensation of the walls.

1. *THE SIMPLE CYSTS* ; with fluid contents. Of these the most common are the following :—

1. *The Serous*.—The cyst usually consists of condensed fibrous tissue, lined with a tessellated epithelium ; the contents are serous, more or less normal in character. The formation may be single, or in numbers ; the site anywhere ; but specially in or near glands, and in the subcutaneous tissue of the neck—there sometimes termed “Hydrocele.” When tense they may simulate solid tumours ; generally, however, fluctuation is distinct ; and the absence of all inflammatory accompaniments sufficiently distinguishes from abscess.

The most ordinary treatment is by tapping and injection of iodine, as in the case of hydrocele of the tunica vaginalis. Sometimes, instead of injection, it is enough to puncture and break up the cyst by the point of a knife or needle. Sometimes, as in the eyelids, it may be well to use lunar caustic lightly to the interior after incision. When the cysts congregate in clusters, as in connection with the mamma, it may be necessary to dissect out the whole mass, including the gland.

2. *Sanguineous Cysts* differ from the preceding mainly as to their contents. These are blood, or bloody serum, and hence have been called “Hæmatoceles.” They are most common in the subcutaneous tissue of the neck and trunk ; and are best treated by incision—turning out the contents, and ensuring destructive suppuration of the cyst, with or without the use of caustic. If there happen to be a connection with erectile tissue, care must be taken lest hemorrhage ensue, either at the time of incision, or subsequently.

3. *Mucous Cysts* “are commonly derived either from cystic disease of the so-called mucous glands, or from dilatation of obstructed ducts or reservoirs” (PAGET). The contents are of mucous character, pure or mixed. Treatment is as for the preceding ; making very sure of the cysts’ destruction.

4. *Synovial Cysts*, adventitious formations in connection with joints and bursæ (anywhere that undue pressure comes to be applied) are probably due to the third mode of origin formerly noticed—an isolated hypertrophy in the connective tissue. They may inflame and suppurate ; so working out their own cure. Or, in the quiet state, they may be made to disappear gradually under iodine or other discutients—removal of the cause (inordinate pressure) being of course not neglected. Or they may be punctured, emptied, and injected with iodine ; or, after puncture, the contents may be squeezed into the surrounding areolar tissue,—a blister being afterwards applied, if necessary, to expedite absorption.

II. *THE PROLIFEROUS CYSTS*, of various contents, are a more important class. We shall speak of three varieties—the Cystigerous, Cutaneous, and Sarcomatous.

1. *The Cystigerous*—most frequently exemplified in the ovary. From the wall of the primary cyst, other cysts form, of various size and thickness, and with fluid contents sometimes glairy and clear, sometimes dark-coloured and turbid through admixture with pus or blood. Growth

though usually slow, may ultimately attain to great size. Treatment varies according to circumstances ; sometimes we are content with tapping and palliation ; sometimes we tap and inject ; sometimes we venture on extirpation of the entire mass.

2. *The Cutaneous*—sometimes termed *par excellence* “*Encysted tumours*”—are either lined with cutaneous structure, or from a simple cyst there is secreted more or less of the usual products of skin. Sometimes they are deep-seated, as in the ovary ; more frequently they are superficial—subcutaneous. Sometimes they are congenital, as in the lower part of the forehead. Much more frequently they form after birth.

The most frequent site is on the surface of the body, more especially on the head and face ; and then the cyst is often merely an enlargement of original texture. For there seems no reason to doubt the origin of many of these *Wens* from obstruction or imperfect congenital development of an ordinary sebaceous follicle, and consequent dilatation by accumulation of its contents. Were the swelling rapid and inflammatory, a pimple or boil would form. But the growth is very gradual, and wholly non-inflammatory. The sebaceous secretion accumulates, and distends the follicle ; the parietes of which are not merely expanded, but receive support by nutrition, and by condensation of the surrounding parts. The obstructed orifice may for some considerable time remain apparent as a black central point ; afterwards wholly disappearing, and the tumour becoming enveloped by smooth, tight, and thin integument, without breach or depression.

The scalp and eyebrows are the parts most frequently affected. In the former situation, they seldom occur singly, but in numbers ; and vary in size from a pea to an orange. In the latter—as well as in the eyelids—where the simple serous cysts, however, are more common—they are sometimes found single ; and seldom exceeding the dimensions of a pea or bean. The cyst, if un-irritated by pressure, friction, or other stimuli, is but loosely adherent to the surrounding parts ; delicate in the eyelids ; strong and thick in the eyebrow and scalp. After repeated or habitual excitement, it becomes intimately incorporated with the parts exterior ; and can be separated from them only by regular dissection. The contents are various ; at first sebaceous, being merely an accumulation of the ordinary secretion, somewhat perverted ; afterwards, and usually soon, changes occur. Sometimes, the contents are of semifluid consistence, like honey, and are termed meliceritous ; sometimes like pap, atheromatous ; sometimes fatty, steatomotous ; sometimes they have a fibrinous appearance ; sometimes, in consequence of the cyst having assumed the inflammatory process, they are of a purulent character. By persistence



Fig. 54.

Fig. 54. Section of a cutaneous tumour. The interior filled with solid epidermic secretion.

of the inflammatory attack, an open condition may be produced, and a state of foul ulcer presented. And, under the circumstances last mentioned, degeneration into medullary formation, or cancerous ulcer, is not impossible; more especially if the patient be advanced in years, and if the inflammatory accidents have been of repeated occurrence. Sometimes, after the open condition has been attained, all inflammatory change ceases; and yet the part does not heal in the ordinary way; but, exerting an extraordinary cuticular function, it commences a horny growth, which, if unopposed, may attain to large dimensions. Such horns, several inches in length, and bulky in proportion, have been cut from the forehead, and from various parts of the scalp. Sometimes calcareous matter, even in considerable abundance, is found in the substance of the cyst itself, and in its interior.

The contents of the thin cutaneous cysts which occur in the eyelids are usually colourless and glairy. Not unfrequently, they contain hairs, of much delicacy, like stunted eyelashes; without bulbs, and more frequently unattached than adherent to the sac. Ovarian cysts have been found to contain not only hair, but skin, teeth, and bones—as if the aborted development of another creature.

Treatment.—The superficial encysted tumours of the scalp, and face, are those with which the surgeon is most frequently called to deal. If recent and small, with the vestige of an obstructed orifice still visible, they may be got rid of by expression. With the point of a pin or probe, the aperture is re-established; and through this, long strings of sebaceous matter may be squeezed out, by gradual pressure of the finger and thumb, until the cyst is emptied. The pressure may require repetition; the cyst contracts; the aperture remains pervious; and the normal condition is restored.

In the great majority of cases, however, there is no vestige of opening, the contents have ceased to be of a sebaceous character, and this method of treatment is inapplicable. If the size be not great, and if the part have not been irritated by accident or design, the method of incision and evulsion is to be preferred; a method applicable to the great majority of such tumours of the scalp. The tumour is transfixed and bisected, by a scalpel or bistoury. The contents are extruded, so as to disclose the cyst; and this, having been firmly laid hold of by well-pointed dissecting forceps, at its cut edge, is lifted out of its place, unbroken. If any adhesion prove stronger than was expected, it is to be touched by the edge of the knife. It is seldom that any vessels demand ligature. After oozing has ceased, the integuments are carefully replaced and adjusted; and the treatment is conducted so as to favour adhesion.

When the tumour is large, redundancy of integument would result from the employment of this method; favouring suppuration, profuse and tedious. In such cases, therefore, excision is expedient. By two elliptical incisions, a sufficient amount of skin is taken away; as in the removal of a solid formation. And then dissection is proceeded with regularly; great care being taken that the knife do not puncture the cyst; otherwise, by escape of the contents, the tumour would collapse, and completion of the operation be much impeded. Also, in consequence of such misadventure, we might not be certain of having removed the

whole cyst; a point which is indispensable in all cases. For, if the slightest part of the secreting surface remain, we may be well afraid either of reproduction, or at least of troublesome consequences.

To the slender cysts of the eyelids, neither the method of excision nor that of evulsion is applicable; the cyst is too delicate to admit of either. Incision, with cauterization, is to be practised. The cyst having been opened, its glairy contents are discharged; and a pencilled point of nitrate of silver is then applied to every part of the secreting surface. This is wholly destroyed; and, having come away in the form of a small slough, the space soon fills up and cicatrizes. For a structure of such delicacy, nitrate of silver is found to be quite a sufficiently powerful caustic. To use a stronger, would be to inflict unnecessary pain; and also, by destroying an unnecessary amount of texture, to endanger the occurrence of some deformity by cicatrization. Sometimes incision, followed only by a tearing up of the interior by means of a sharp probe, or knife, proves effectual; but, as a general rule, it is better to make the desired destruction certain, by a light use of the gentle escharotic.

The thin cysted encysted tumours occurring in the neighbourhood of the eyebrows, if interfered with at all, should be carefully dissected out, without opening the cyst.

An encysted tumour, inflamed and suppurating, is treated as an ordinary abscess; by free incision. No escharotic is necessary. The cyst is sufficiently disintegrated by the ulceration.

When degeneration has begun in an encysted tumour, or a horn threatens to grow, the part must be surrounded by free incision, and carefully dissected out, at as early a period as possible.

Inflammatory change in an encysted tumour is never desirable; for the process is apt to prove excessive, unmanageable, and altogether untoward. In certain situations, it is by all means to be avoided. On this account, mere puncture of an encysted tumour of the scalp, however small and simple, is never expedient; suppuration is sure to follow; and erysipelas, in a dangerous locality, is not unlikely still further to complicate the case.

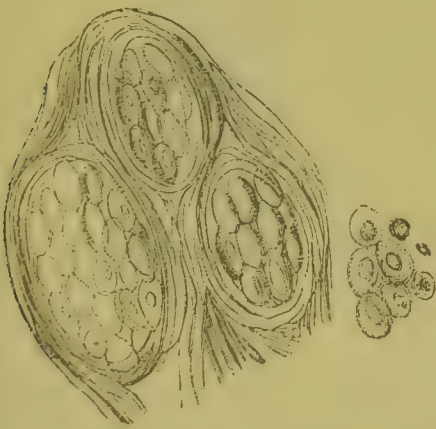


Fig. 55.

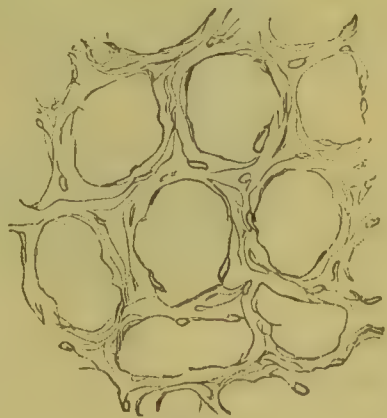


Fig. 56.

3. *The Sarcomatous.*—For want of a better term this may be em-

Fig. 55. Portion of a cystic tumour of the breast, successfully excised. The cysts contain fibro-plastic cells. *a*, A few of the latter after the addition of acetic acid.

Fig. 56. Another portion after the addition of acetic acid.—BENNETT.

ployed to designate those cysts from whose interior organized and vascularized product occurs of a more or less solid consistence, microscopically shewing the characters of developing connective tissue—sometimes with an admixture of “glandular” substance. At first the cyst may contain fluid—serous or other; but on the development of the solid matter this is displaced and absorbed. The cyst may be entirely filled by its solid product, or only in part. In the former case, the growth may eventually break through the wall of the cyst, and project externally.

Such cysts are seldom single, but occur in clusters; and are most frequently found in or near glands. They are amenable to but one mode of treatment—Extirpation.

CYSTIC-SARCOMA.—Cysts, of various kinds, are not seldom found distributed through solid stroma, of a simple or non-malignant character; and to this combination of solid and hollow growths the old term “cystic-sarcoma” may still be conveniently applied, though scarcely, perhaps, consistent with scientific classification.

The solid structure may resemble that of the glandular, fibro-cellular, or fibrous tumour. The cysts are not mere vacant spaces, caused by breaking down of the solid matter, as often happens in the malignant formations; but are part of the original structure, lined with a distinct secreting membrane, and occupied by contents of various kinds. These are usually more or less fluid; sometimes a clear, glairy liquid; sometimes a gelatinous, pale mass, of semi-solid consistence, elastic, and projecting beyond the level of the cut cyst on a section being made; sometimes solid and fibrinous, organized imperfectly if at all; sometimes of an atheromatous, or pappy consistence, as in many encysted tumours. Sometimes, but more rarely, a dark fluid, like printer's ink, is contained; sometimes, blood is mingled with the contents, either in the solid or in the coagulated form; but such appearances are usually indicative of, and coeval with, degeneration of the tumour towards malignancy. Sometimes

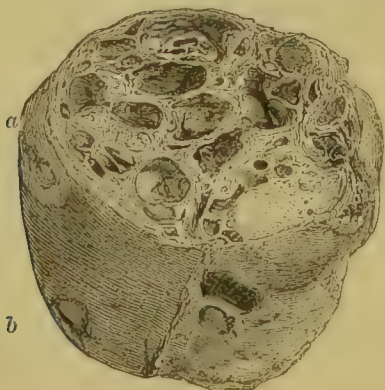


Fig. 57.



Fig. 58.

the cysts are numerous and small; in other cases, they are few and of large size. Sometimes they are single in themselves; sometimes many

Fig. 57. Example of cysto-sarcoma; from the breast. At *a*, the cysts many; distinctly lined by a secreting membrane, and filled with a glairy fluid. At *b*, a section made on another plane; cysts less numerous.

Fig. 58. Cysto-sarcoma from the neighbourhood of the mamma. One large cyst, *a*; at *b*, the solid part of the tumour—a simple stroma.

smaller cells are contained within a parent, attached by narrow peduncles; often, as already stated, the cavity—or what was the cavity—is occupied by a thoroughly organized mass—the *Cysto-sarcoma proliferum* of some authors.

Such cystic tumours are perhaps most common in connection with the mamma, testicle, and thyroid gland. They are of no certain shape, but approach more nearly and frequently to the globular than to any other form. The integuments are not implicated; yet usually shew more or less of discoloration, especially at the points where the cysts are placed. The feel is unequal; at the cysts there is fluctuation, more or less distinct—the more distinct the larger the cyst and the more fluid the contents.

Though primarily and essentially non-malignant, yet they are especially liable to degenerate; perhaps in consequence of the independent secretive power which the cysts possess, and which may at any time take on a perverted and depraved character. Hence, there can be little doubt as to the propriety of early removal by operation.

III. *The Recurrent Tumours.*

A class of morbid formations, intermediate between the benign and malignant, and partaking of the characters of both, may be suitably introduced here. They have been appropriately termed *Recurrent* by Mr. Syme, on account of their prominent peculiarity in this respect. In all ordinary characters, they might be adjudged to the innocent class of tumours; but, in one particular, they closely resemble the malignant—prone to reproduction after complete and even repeated removal.

They ordinarily present the characters of fibro-cellular or fibrous tumours; and on that account were at first termed by Mr. Paget “Recurrent-fibroid.” “But some have been cartilaginous, some glandular, some in the form of proliferous glandular cysts.” In all yet observed, “their structures are imperfectly developed; resembling the embryonic or rudimental, rather than the perfect states of the several natural tissues”—(PAGET). When handled they feel more soft and elastic than perfectly simple tumours of the same class; they grow more rapidly too; and, on each reproduction, the new tumour proves softer, as well as more quickly growing than its predecessor.

Their likeness “to cancers in many of these points is evident. But their unlikeness is as distinct. They rarely look like cancers to the naked eye, never to that assisted with the microscope; their homology with the natural structures, though in a rudimental and it may be degenerate state, is clear. They do not affect the lymphatics; their recurrence is *in loco*; and in the few cases in which, late in the disease, similar growths have occurred in the lungs, it may be suspected that the propagation was by direct carrying of germs with the blood from vessels into which a tumour had grown. Moreover, after repeated recurrences, the patient commonly retains apparently good health, and shews none of that cachexia which would almost certainly exist in a patient who had suffered repeated recurrences of cancer”—(PAGET).

Treatment can only be by excision; and the peculiarity will consist in

this—the removal being specially ample and free, *with a margin*, as in the case of malignant tumours, so as to guard, as far as possible, against any radicle being left behind.

IV. *The Malignant Tumours.*

We now take leave of analogy of structure with benignity of character, and come to heterologous formations, truly malignant. These change altogether the original texture; invade the surrounding parts, converting them into a similar structure with themselves; and extend not only by continuity, but remotely, by the lymphatics; the lymphatic ganglia enlarging, not so as to constitute a mere hypertrophy, but a production of the same kind as the original tumour; and the system is involved in a cachexy, too often insuperable, whereby reproduction of the disease is rendered in the highest degree probable, at one or at many sites.

Malignant tumours generally abound in cell-formations, and in blood-vessels; hence in

all probability their rapid growth and quick disintegration. The cells are commonly contained within the meshes of a fibrous structure; which is sometimes however in very small quantity, as in the softer varieties of medullary tumour. The cells present a high degree of development; containing one or more nuclei, of large size as compared with those of normal cells; and these again containing nucleoli.

Following Mr. Paget, a safe guide in such matters, we may take the corpuscles found in scirrhus as the typical “cancer-cells.” In shape they are various; usually a large majority are broadly oval, or nearly round; in some specimens, indeed, all may have these forms; but, in other specimens, though these prevail, yet many cells have one or more angles, or out-drawn processes; and some are pyriform, some fusiform, some reniform, some nearly lanceolate. In size the cells range from $\frac{1}{1000}$ of an inch to $\frac{1}{700}$ of an inch in diameter. Their medium and most frequent sizes are from $\frac{1}{1200}$ to $\frac{1}{1000}$; the smaller dimensions are usually

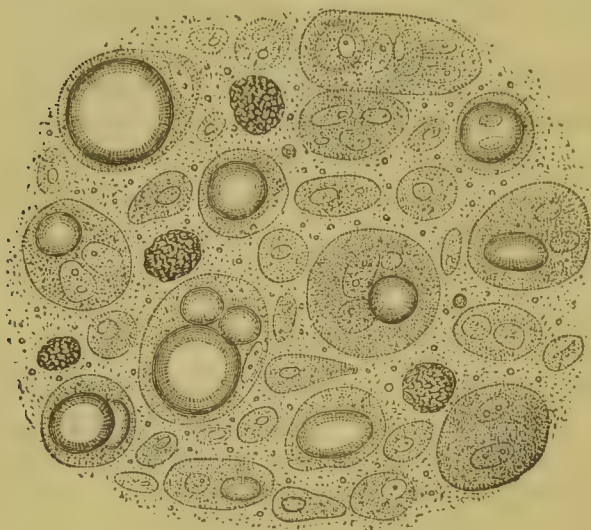


Fig. 59.

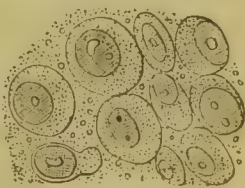


Fig. 60.



Fig. 61.

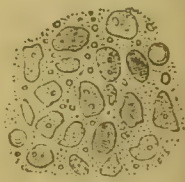


Fig. 62.

Fig. 59. Simple and compound cancer cells from cancerous duodenum.—BENNETT.

Fig. 60. Cancer cells in progress towards full development.

Fig. 61. The same acted on by acetic acid.

Fig. 62. Corpuscles and granules from the same tumour, in progress towards decay.

found in the cancers of quickest growth. In structure and general aspect they most nearly resemble the secreting gland-cells. Examined immediately after removal, and without addition of water, they appear clear and nearly pellucid; but changes quickly ensue, which water accelerates, and which bring them to the characters more generally ascribed to cancer-cells. They become nebulous, or dimly granular, or dotted, as if containing minute molecules; and they look no longer quite colourless, but very lightly greyish or yellowish. The cell-wall is, if it can be seen at all, particularly thin and delicate; but it is often impossible to discern any. The nuclei are more constant in their appearances than the cells, and even more characteristic. They are always comparatively large, having an average long diameter of about $\frac{1}{2500}$ of an inch, and varying from this size much less than the cells do from theirs. They are regular, oval, or nearly round, clear, well-defined, scarcely altered by commencing decomposition, or by water, or any moderately diluted test substance. A certain number of free nuclei are usually

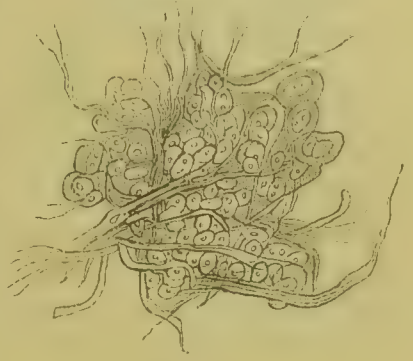


Fig. 63.



Fig. 64.

found. Each nucleus has one, two, or rarely more, nucleoli, which, like itself, are large in comparison with the ordinary proportion between nucleoli and cells, and one peculiarly bright and well defined.

These structures are apt to degenerate; and are to be found so changed, more or less, in most tumours; withered, or containing fatty matter, or broken down with nuclei lying loose in the debris.

From such "typical cells" the minute structure of the varieties of cancer differ, more or less, as will afterwards be stated.

The cells of malignant growths are in such numbers that they communicate a yellowish creamy character to the viscid fluid, which can be squeezed or scraped in considerable abundance from the surface of a section. This creamy fluid is very characteristic, in general, of such tumours; and distinguishes them especially from the fibrous growths, which are dry in section, and yield only a minute quantity of serum or blood on pressure.

All malignant tumours resemble one another in most of their essential characteristics; and yet they differ so far as to warrant a classification. Practically, it seems convenient to arrange the varieties as follows: 1. Scirrhus, Carcinoma, or hard cancer; 2. Epithelioma; 3. Medullary or soft cancer; 4. Melanotic, or black cancer; 5. Colloid cancer; 6. Fungus hæmatodes.

Fig. 63. Cancer cells, with their stroma.—PAGET.

Fig. 64. Characteristic cancer-cells of scirrhus.—PAGET.

1. SCIRRHUS.—This tumour may be either secondary or original. Much more frequently it is the latter; secondary formations, by degeneracy, being usually of the medullary form.

When primary, as it generally is, scirrhus has a small, firm origin, and steadily increases; usually with much pain from the beginning, of a sharp and shooting kind. The hardness to the touch is greater than in any other tumour, excepting perhaps the fibrous; it is stone-like. Weight also is great, in proportion to the bulk. The form is not globular and circumscribed, like that of the fibrous; but flattish, irregular, and gradually lost in the surrounding texture; at least without any abrupt or distinct margin of separation. The growth of the tumour is not rapid; greater than that of the fibrous tumour, but less than that of the other simple formations, and infinitely slower than that of the medullary. And it may be stated as a general rule, that the older the patient the slower the growth. In the comparatively young—say forty—months may suffice for far advancement; and in the old—say seventy—years may have passed away, with a tumour yet hard, small, occult, and but little painful. When the tumour forms in the substance of an organ, as the mamma, the part grows smaller as it grows hard; for the tumour slowly increases, and at the same time the normal texture and the first-formed portion of the growth tend to shrink by atrophy. By and by the surface may be approached by the intervening textures becoming involved in the morbid structure; or by cancerous development of the intervening connective-tissue corpuscles the skin is ultimately incorporated, becoming dark-coloured, depressed, and adherent. This usually happens at a comparatively early stage.

At first the tumour is movable; but ultimately, by incorporation with neighbouring parts—skin superficially, and muscle beneath—it becomes fixed. By gliding with the muscle, however, to which it is attached, over the subjacent bone, mobility may be simulated. A scirrhus mamma, for example, fixed deeply in the pectoral muscle, may thus seem superficial to it; and careful examination is required for accurate diagnosis in this respect. Sometimes the scirrhus passes into the medullary, either wholly or in part; then the characters of the former are merged in those of the latter; the tumour becomes soft, prominent, and elastic, growth is rapid, and the size may become great. A cachexy attends on this as on all other forms of cancerous disease: it is evidenced by emaciation, a marked sallowness of countenance, and sometimes by irregular hectic fever; but this last symptom is not usually distinct until emaciation has begun. The disease seldom makes its appearance until mature age; rarely before thirty; more frequently after at least ten years more have elapsed. Females are more liable to it than males; and the females



Fig. 65.

who have borne no children are more likely to suffer than those who

Fig. 65. Scirrhus of the breast, bisected. The figure of the tumour, with its effect on the gland and nipple shewn.

have been often pregnant. The mamma, uterus, testicle, lip, skin, and mucous surfaces, are the most frequent sites; and especially the first.

On section the tumour is found to be of great density; in this respect almost equal to cartilage; it "cries" under the knife, cutting like a raw potato or unripe pear. It consists of two distinct portions; an interlacement of fibrous tissue, in the interstices of which a granular substance is laid, of a grey colour; and the characteristic "juice" can be squeezed out readily. The general aspect of the section is dense, fibrous, and grey.

Microscopically, scirrhus shews a distinct basis of fibrous tissue, between the meshes of which are contained multitudes of cells of the kind already described. When the development of these cells can be observed, as for example in the connective tissue of muscular sheaths, or even in muscle itself, the nuclei of the connective tissue corpuscles in the one instance, and the nuclei contained within the sarcous substance in the other, are found to become multiplied. This multiplication continues till all trace of the connective tissue corpuscle or sarcolemma is destroyed; and then a mass of cancer-cells remains enclosed among the surrounding tissues, which in turn become implicated in the disease. And thus by the coalescence, partial or complete, of groups of cells originally formed separately within normal elementary structures, the diseased mass is formed; presenting varieties of combination of original tissues with fibrous textures and cancer-cells, mingled in the apparently inextricable confusion which is to be seen in any fully developed cancerous growth. "What is called a tumour constitutes" therefore "a conglomerate mass, often extraordinarily large, made up of a number of little miliary foci (lobules), of which every single one must be referred to a single or a few parent elements."—(Virchow.)

In all cancerous formations, portions may be observed which by the naked eye are seen to be darker in colour than the rest. These are generally of a yellowish tint; and are found to present very imperfect and often degenerate cancer-cells, as if the formative process had here stopped, and the disease were at this point retrograding. At the same time, there is commonly a larger quantity than usual of the granular product. In the mamma a number of yellowish opaque points are sometimes seen on the surface of a section; giving, when pressed, a yellow juice, and leaving a somewhat reticulated arrangement. This is the *Carcinoma reticulare* of Müller, and indicates the incipient decay and fatty degeneration of the cancer-cells, which are in such parts generally found more or less broken up, and loaded with granular matter (Fig. 62).

When the tumour is original, it is seldom surrounded by any cyst or capsule; but extends diffusely into the surrounding texture, following the course of the connective tissue anastomoses; being most rapid where their anastomoses are most free, and least so where they are absent (brain and cartilage). Thus the communication from part to part is precisely in the same manner as that by which the neighbouring lymphatic glands become affected, viz., by the circulation of a fluid formed in the tumour, and either containing contagious cell elements or being itself contagious. When it is of secondary formation, the cyst of the origi-

nally simple mass for some time remains uninvolved, but ultimately disappears in the general invasion of structure.

The term *Cancer* is sometimes used specially to denote the open or ulcerated condition of Scirrhus. The tumour, having approached the surface, softens in some parts of its interior; the scirrhus texture becoming broken down, pulpy, and often mixed with blood. This process of softening and disintegration—the result, possibly, of an inflammatory process—certainly consisting of rapid cell formation and fatty disintegration—spreads outwards; and, by its agency, an ulcer is in due time effected. There is no sprouting fungus, as in the medullary tumour; for the morbid structure is devoid of elasticity, as well as less rapid in its production. The sore widens and deepens; the scirrhus texture, where exposed, continues to crumble down; and the reparative efforts which are occasionally made shew only a few, straggling, hard eminences, which quickly fall away under fresh ulceration. While, however, reparative efforts are few, and wholly ineffectual—as regards healing—reproduction as regards the diseased structure is constant and efficient. Portions of the tumour may come away, not in particles, but in masses; but generally there is little or no diminution or abatement of the disease, in consequence; the place is soon occupied by fresh formation, and the onward

Fig. 67.



Fig. 66.

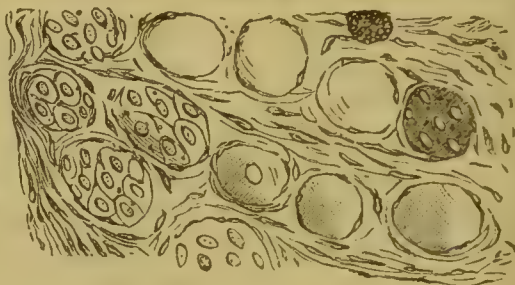
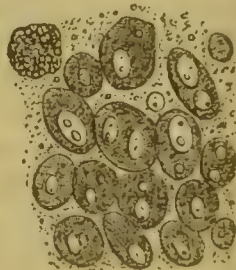


Fig. 69.



Fig. 68.



progress is unchecked. Sometimes, however, the ulceration advances rapidly, without reproduction, forming a deep and cavernous hole.

The characters of the cancerous ulcer are very peculiar; and, once seen, can scarcely again be mistaken. The edges are hard, serrated, and

Fig. 66. Portion of the section from a scirrhus tumour of the breast; consisting of connective tissue and cavities, enclosing cancer cells and granules.

Fig. 67. Another portion of the same section treated with acetic acid. The connective tissue is rendered more transparent, and its elongated cells are more visible. The nuclei of the cancer-cells are unchanged, while their walls are very transparent.

Fig. 68. Cancer cells from the cream-like juice squeezed from the tumour.

Fig. 69. The same after the addition of acetic acid.—BENNETT.

overted ; the eversion complete ; the hardness as that of cartilage ; sometimes of a red and angry hue. The surface discloses the morbid structure, soft, and in process of ulceration ; studded at some points, more especially near the margin, with the semblance of granulations already spoken of. The discharge is thin, bloody, and profuse ; possessed of an intensely foetid odour, so peculiar as generally to be held of a pathognomonic character. Pain is burning and constant. There is no power of cleaning this sore ; under every application, it looks foul and loathsome. Sometimes it is covered by a black or tawny slough. Not unfrequently, a dark, bloody oozing takes place, from some part of the ulcer, perhaps on separation of such a slough ; sometimes there is smart hemorrhage.

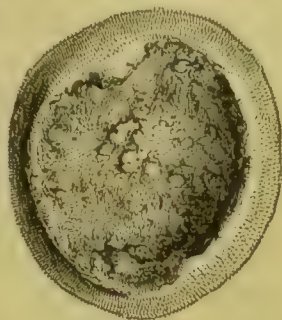


Fig. 70.

One peculiarity of scirrhus and cancer is, that the disease is especially prone to extend by the lymphatics. Sharp, stinging pains are felt in the direction of the main lymphatics and their ganglia ; shadows of the coming event. Then hard and tender cords are observed, extending from the tumour on the lymphatic aspect ; sometimes with small indurations by their side. These cords may stretch, unbroken, to the ganglia—as in the axilla ; and there a second tumour, in all respects like to the first, but often of more rapid growth, and more distressful in its symptoms, begins to form. Or this may take place with few or none of these premonitory symptoms ; without cord or kernel in the intervening space. This extension by the lymphatics is due, as already noticed, either to the absorption of a cancerous fluid or cell elements, which being carried along the lymphatics, lodge in the glands, and these establish a cancerous formation, or to the lymphatic vessels becoming diseased, and their elementary structures developing by connective tissue anastomoses into cancerous formations. Œdema now occurs in the limb, whose lymphatics have been thus obstructed, and the swelling may be great. Pain is constant, severe, and sometimes excruciating. So much so, that often the patient's attention is entirely diverted from the original malady, and fixed on the part which has become so swoln and painful. The cachectic state of system becomes more and more aggravated ; sleep is gone ; appetite fails ; emaciation is great, and still increasing ; the sallow, wan, cadaverous expression of face becomes more marked ; the whole frame grows bloodless ; a malignant hectic, as it may be termed, is established ; and life is gradually exhausted, in much misery. In such cases cancer will very frequently be found developed in internal organs, as the liver and lungs—due it has been supposed to a cancerous absorption through the medium of either the venous or lymphatic systems. In the former case, it is supposed that cancerous developments, forming within the veins connected with a tumour situated externally, are carried hence by the circulation and lodge elsewhere ; or, according to the other hypothesis, a cancerous lymph is poured from the lymphatic into the general circulation to produce a like contamination. The fact, however, that the liver frequently becomes affected in cases of cancer of the breast, while the lungs, which are more directly in the course of the vascular

Fig. 70. Cancerous ulcer from the scalp.

and lymphatic circulation, remain unaffected, makes it probable that the infection occurs through the medium of the absorbed juices of the cancer growth, rather than by detached cells or masses entering the circulation. Sometimes the fatal issue is accelerated by the accession of an internal disorder, structurally unconnected with the cancer. In cancer of the mamma, for example, pleurisy with effusion is often the immediate cause of death.

The period of lymphatic invasion varies. Sometimes it begins at a very early stage of the primary tumour. In other cases, months and almost years may have elapsed, without as yet any affection of the lymphatics being apparent; but this is as the exception to the general rule. It is seldom that the stage of cancer has been of long duration, without secondary lymphatic formation having been at least apparent; the ganglia, which seemed to remain sound during the occult stage, soon giving way when the open condition has been established. Sometimes the secondary lymphatic tumour is not scirrhus, but medullary.

During the cancerous progress, a peculiar fragility of the skeleton is liable to occur; untowardly complicating the case. On some slight exertion, as turning in bed, walking across the room, or rising up suddenly—or in consequence of some slight injury, by blow or fall—a bone breaks. The patient becomes bedridden in consequence; by confinement the cachexy is increased; and the fatal issue is accelerated. Sometimes the bone unites in the ordinary way, by callus, under the ordinary treatment; and the patient temporarily recovers from the complication. Sometimes there is no union at all. Perhaps, more frequently, there is a reproductive effort, but not of callus; a depraved formation takes place; and, at the site of the fracture, a cancerous mass is soon developed, either newly, or from a cancerous nodule which had previously existed, and which, by attenuating the bone, rendered it thus predisposed to fracture at this spot.

This disease has been supposed contagious; but the evidence on this subject is very unsatisfactory. That it is hereditary, and often transmitted from parent to child, there seems little room to doubt; such taint constituting a predisposing cause. The exciting cause may be injury, or stimulation of a part, in a system previously depraved; and with, or without, the previous existence of other tumour.

Treatment.—It is hopeless, and worse than useless, to attempt discussion of scirrhus. The tumour will only have its energies further roused, and proceed more rapidly to its fatal issue. Besides, valuable time will have been sadly mis-spent, and opportunity lost of affording the most favourable chance of cure—by timely extirpation. Leeching, rest, and the application of cold, may palliate the symptoms, and retard the growth; yet they do nothing towards actual cure; and are reprehensible as consumers of valuable time. But, as formerly stated, benefit occasionally results from discussion of the common products of the sub-inflammatory process, which may have taken place around, and on which much of the apparent bulk of the tumour may depend. Let this attempt, however, be cautiously conducted; on the one hand, so as to avoid the absorption of the cancerous formation; on the other, lest excitement ensue, with increase of the formative effort, whether in or around the tumour; as from either of these extremes nothing but harm can follow.

If it be true that the elementary cells of such growths are capable of insidiously developing themselves in surrounding textures, without manifesting their presence by any change recognisable by the eye or touch, it becomes very plain how perilous must be the induction of any excitement by stimulation, in any way, or with whatever object in view; the cells are already multiplying, perhaps in considerable numbers, within the connective tissue elements, even to a considerable distance from the main tumour; and, on the removal of that, even by wide incision, new development may quickly form from these structural elements to take its place. This pathological inference would seem to be favoured by the clinical fact, that after removal of scirrhus by operation, especially from the breast, the usual mode of return, at the original site, is not by the formation of a single tumour as before; but by the appearance of numerous, small, stony, and painful kernels, so superficial as to seem integumentary; after a time uniting to form a confluent mass, which ulcerates and otherwise advances untowardly, in the ordinary way. At the same time, the proposal that the microscope should be a constant portion of the surgeon's armamentarium in the operating theatre, when a tumour is the subject of operation, receives no support from carefully conducted pathological research; for the extension of the morbid cell multiplication of a cancerous type within the connective tissue does not necessarily affect equally the general surface of the wound, but extends preferentially along the minute lymphatics, the neurilemma of nerves, and in the connective tissue elements which exist around blood-vessels, in muscular sheaths, and within the textures of muscles—requiring too carefully conducted research and time to demonstrate their presence.



Fig. 71.

Of late, attempts have been made to effect a cure by means of compression, steadily and uniformly applied. Arnott's apparatus accomplishes the maintenance of such pressure very admirably, and, as already stated, may diminish general bulk by absorption of the ordinary inflammatory products. It may also retard the growth of the tumour itself; but in few cases, if any, may actual cure be looked for. If employed so as to excite formative action in the part, or extension of the disease, or adhesion of the mass to surrounding parts of importance, which cannot afterwards be removed along with the tumours, harm must ensue, as above shewn.

Rubbing the part may diminish bulk, in the same way as pressure; but, in other respects, is obviously not so safe an application. That a scirrhus or other malignant growth should be dispelled and cured by systematic rubbing, is of course altogether visionary—or worse.

Congelation of the affected part, by means of pounded ice and salt, often

Fig. 71. Scirrhus; secondary. An example of the numerous nodulated tumours, which often form in the cicatrix of the former growth. One is ulcerated, in the site of the mammilla.

has the effect of alleviating the symptoms, if not arresting the growth of the disease. Under its use I have repeatedly seen the angry cancer calm down, cease to extend, and even temporarily cicatrize. The application need not be continuous, or at all severe; only occasional, and regulated very much by the feelings of the patient.

Is there a specific for cancer? is a question which we need not hesitate to answer with a decided negative. Many have been declared, and many have been tried as such; yet all with one issue—failure. Some, comparatively harmless, failing in the main object, yet may have palliated suffering, and even somewhat delayed advancement. While others, of a stimulant nature, favoured the tumour's increase, bore further down the system, and rendered death both more early and more wretched.

The only chance of cure is by direct, early, and thorough removal of the morbid structure; and this may be effected either by caustic or by incision. The actual cautery has been employed with this view; but is now in most cases laid aside. Potential cauteries—potassa fusa, mineral acids, chloride of zinc, arsenic—have held their place longer, and with a better prospect of continuance of tenure. The best mode of applying them is with incision. The skin having been removed by knife or caustic if necessary, the chloride of zinc, or strong acid, as it may be, is applied freely, so as to produce a slough. Ere this has begun to separate, it is incised at various points so deeply as merely to expose the living texture beneath; and through these incisions the caustic is again applied, so as to produce a second slough, which, having been incised in its turn, becomes the medium of transmitting the third dose of caustic to a fresh layer of the diseased mass beneath; and so on, until there is reason to believe that the whole of this has been destroyed—converted into eschar. Separation of this is then awaited, and when it has taken place the remaining sore is treated according as its condition may require, with a view to healing. By some, cakes of saffron soaked in monohydrated sulphuric acid (Velpeau), or charcoal powder, or sawdust, formed into a *magma* with the same agent (Ricord, Syme), have been applied with considerable success to effect the destruction of the cancerous mass. If employed, the parts around must be protected either with a thick layer of soap-plaster, or with a thick shield of gutta percha, moulded to the part, with an aperture corresponding to the size and site of the tumour to be destroyed.

The advantages of this mode of removal are, that it is to some patients less formidable than the use of the knife; sometimes, too, it is comparatively void of pain; besides, there is no loss of blood, and the shock to the system is sometimes but slight—the patient walking about, and so maintaining the general health apparently unaffected; and by the contraction of the growing eschar, outlying points of the tumour—as glands—may be gradually drawn from their distant dangerous localities, to be acted on safely by the caustic in the latter stages of its use. The disadvantages, on the other hand, are the uncertainty of the caustic's range, the prolongation of the act of removal, and the risk of causing an acute development of cancer in the connective tissue elements all around.

Such cauterization, however, may very properly be had recourse to when the patient refuses the knife, or when the bearings of the tumour or

tumours are such as would bring the knife unpleasantly near to important parts. It may also be used sometimes as an auxiliary, when the knife has taken away as much as it can, and a suspected portion yet remains, inaccessible to its edge ; or when the disease returns in the wound before cicatrization is complete.

On the whole, however, we incline to believe that excision is the preferable mode of removal, in the majority of cases ; by a free, cautious, and wide dissection. Care being taken, that not only the whole of the morbid structure is taken away, but also that a border of apparently sound texture goes with it ; in order, if possible, to make sure that none of the textures likely to contain the germs of the disease are left behind. In regard to such dissection, it is useful to remember, that dense fibrous tissue resists the invasion of scirrhus longer than any other ; and that, consequently, the incisions need be less free beyond that tissue, even where it is partially incorporated with the tumour. But yet, in all cases, the propriety is obvious of approaching error on the safer side ; rather sacrificing texture unnecessarily, than encountering the risk of leaving a nucleus of reproduction behind.

Some, taking an abstract view of the subject, entertain a question as to the expediency of operating at all in cases of scirrhus ; inclining to regard the affection as wholly constitutional, and not to be eradicated, or even restrained, by removal of only a local manifestation. This view we do not propose to consider ; but, with the majority of the profession, granting that the disease is constitutional as well as local, and that in most cases it shews as much of the former as of the latter character ; granting that very many cases occur—doubtless the majority—in which operation is inexpedient ; and granting that in all cases, looking to the constitutional vice, we can never be certain of immunity from return, and must invariably issue a guarded prognosis accordingly :—still we are of opinion, that there are cases, not seldom presenting themselves to the surgeon in extensive practice, in which it is his bounden duty, by operation, to afford his patient the chance either of a definite and radical cure, or at least of a postponement and palliation of the malady. Such cases are those in which the tumour is yet small, and comparatively circumscribed ; the lymphatics unchanged, either in the immediate vicinity or at a distance ; the integuments and muscles free from incorporation ; the patient neither young nor very far advanced in years ; and the cachexy as yet but little indicated, if at all. On the other hand, affection of the lymphatics, already begun, even though to no great extent, contra-indicates operation ; for, according to experience, reproduction is almost sure to follow, even when the surgeon is certain that not only the tumour itself, but the adjoining changed structure as well, lymphatic or not, has been thoroughly taken away. Incorporated skin and muscle can be removed, by wide and free incision ; yet, in such cases, it is often difficult, if not impossible, to say that what is left is sound, free from lodgment of the *materies morbi* already in its texture ; and, in these circumstances, experience again gives unfavourable testimony as to the ultimate result. In the very old, a scirrhus may exist for years, in a latent or indolent condition ; still occult, and still of small size and circumscribed ; the seat of little uneasiness, and attended with but little disorder of the system ;

indeed the patient may die, ultimately, of disease to all appearance totally unconnected with the scirrhus. Under such circumstances, operation is withheld; the tumour is left undisturbed, and guarded carefully from excitement. But while thus, in the patient of seventy, the progress of the tumour is slow, and the indications of cachexy weak or apparently absent—the opposite obtains in regard to the patient of forty, or less. And when, at such age, a tumour is advancing rapidly, with a marked cachexy at the same time consuming the general frame, it is prudent to abstain from the knife, even though the lymphatic system seems as yet wholly uninvolved; for, in such cases, besides the possibility of concurrent internal cancerous complication, the probability of return is extremely great; the disease being not delayed by the operation, but truly undergoing exacerbation. And thus we see, that extreme activity of the disease in the comparatively young, and extreme indolence of it in the aged, both alike contra-indicate operation. It may also be observed, that, *cæteris paribus*, return is more probable in the case of the open tumour, than of the occult.

In those cases in which there is freeness of integument, and laxity of all the surrounding textures, it is well to conduct the incisions and subsequent treatment so as to favour adhesion of the wound, and mobility of the cicatrix; for such a state of matters is found favourable to immunity from return; while tedious suppuration and granulation, resulting in a tight, firm, adherent cicatrix, strained by each movement of the part, have an opposite tendency. All irritation of the cicatrix, of whatever kind, should of course be carefully avoided.

An important question arises, whether, after thorough removal of the apparent local disease, by operation, we have any means of staying, or altogether removing, the constitutional vice; and so securing a permanent cure, by immunity from return. It is to be feared that this can as yet only be answered in the negative. Conium has long enjoyed a certain reputation as possessed of such a virtue; and by some surgeons, it is trusted in, and administered accordingly. A tonic system of general treatment—preceded, if need be, by alteratives—is indicated, to assist in prevention or arrest of the cachexy's development; and the preparations of iron are usually found suitable. Arsenic, too, may be of service, in this way; though not as a specific.

When return has occurred, under what were supposed favourable circumstances, there may come to be a question as to the expediency of further operation. If the return be in the usual manner, with ulceration and tumour of the cicatrix, numerous superficial nodules around, and obvious involvement of the lymphatics, no good can result from further interference by the knife. But if the return be by an occult, small, and limited tumour, as sometimes happens, and if the general system be yet comparatively sound—then by a second, and if possible still more careful and complete operation, the remaining chance, slight though it must be regarded, ought certainly to be afforded—especially if requested by the patient.

In the truly hopeless cases, we content ourselves with palliation. A rigidly spare regimen will be found to do no good by delaying the tumour's growth, while it does much harm by favouring the cachexy's

inroad on the general frame ; the diet should be simple and non-stimulant, yet nutritive, and rather full than otherwise. By opium and other anodynes, exhibited internally, sleep is procured, and pain of the part and neighbourhood allayed. No stimulants are applied to the tumour ; on the contrary, all such are carefully avoided ; it is our object locally to soothe ; and, for this purpose, opium, belladonna, conium, may be employed in the form of epithem. In the ulcerated state, much relief is often experienced from the frequent, or even constant, use of a plain and light hemlock poultice. Fætor is corrected by the occasional application of solutions of the chlorurets, or other disinfectants, and by strict attention to cleanliness. The part and its vicinity should be kept as much as possible in a state of rest. Local warmth, by some soft article of clothing, as wool or fur, is also expedient. All friction, with or without stimulant embrocations, is in the highest degree pernicious. Were the disease merely local, pressure might perhaps be cautiously conducted, so as to arrest development of the part, or even to obtain a partial decrease ; but, as it is, malignant formation and increase elsewhere, probably in an internal organ, would in all likelihood be the result of temporary obstruction at the original site of development. And besides, ulceration, by over-excitement, is the usual local effect of pressure on such tumours, even when most carefully employed.

Operation, even in the most hopeless cases, may sometimes be deemed expedient, as a mere palliative. When there is a large and ghastly sore—as of the mamma—pouring out much foetid ichorous discharge, and the seat of constant agonizing pain, conversion of the foetid and painful ulcer into a comparatively simple wound may, for a time, afford very marked relief. The ulcerated part is taken away by rapid dissection ; the bleeding points are secured ; the wound is left to suppurate, under simple water-dressing ; no stimuli are applied ; it is seldom that coaptation by suture is practicable, and under the circumstances it is scarcely expedient ; the wound contracts, and may even heal for a time. Or, again, to avoid the loss of blood, which can scarcely be prevented in operations undertaken under such circumstances, caustic may be employed, the patient being placed under the influence of chloroform or opiates, while the caustic is in operation. In any case degeneration ultimately returns, and its advance is again rapid and untoward ; but, during the interval, the patient may have been privileged to enjoy much comparative ease and comfort. In those cases, however—and they are the majority—in which the exhausting shock of an operation, acting on the system, will more than overbalance the contemplated benefit to the part, operation is altogether to be abstained from.

2. EPITHELIOMA, *Epithelial Cancer, Cancroid*, is more analogous in structure, and less malignant in tendency, than any of the other cancerous formations. Microscopically it is found to consist mainly of epidermic or epithelial cells, but little removed in character from those which are primary and normal, but arranged very differently ; not merely clothing the surfaces to which they belong, but, besides copiously investing the enlarged papillæ of the cutis, being rolled into masses, or balls, and also implicating, like other cancerous products, the adjacent and deeper textures. It occurs in connection with skin and mucous membrane ; often where

the two unite—as in the prolabium. Sometimes it occurs in cicatricial tissue. Its most frequent sites may be said to be the cheeks, lips, tongue, hands, penis, scrotum, and anus.

It may begin as a warty elevation; or may early ulcerate. Not seldom it supervenes on warts, or other cutaneous hypertrophy, previously simple. In the occult condition, growth is by no means rapid; but when softening and ulceration have taken place, the sore, assuming the ordinary characters of cancer, may extend quickly as to both surface and depth. Often sprouting eminences appear on the surface, and endure for a while; and sometimes even more successful efforts are made at repair, in temporary cicatrization of at least a part of the sore—the cicatrix always thin, vascular, tense, and obviously most fragile. When the ulcer-

ation takes fairly to a deep and downward course, texture after texture, bone not excepted, gives way, steadily consumed as by a phagedæna. The lymphatics are early involved, manifesting the ordinary characteristics of cancerous infection, but containing cell-structures of the epithelial type; yet the disease is not liable to extension by reproduction in internal and distant parts—so common in scirrhus and cephaloma. Cachexy, too, is slower in declaring itself; and the whole course and character of the malady are mild and chronic, when contrasted with those of its fellows. Its origin may



Fig. 72.

often be traced to irritation or injury; the use of a short hot pipe causing it in the lip, the irritation of soot exciting it in the scrotum—for example.

What is termed *Villous Cancer* may be practically considered as little else than a variety of epithelioma, occurring on mucous surfaces, such as of the bladder and intestines.

There are, however, structurally two forms of the affection. In one, the so-called *villi* consist of the fibrous or muscular textures which normally exist beneath the mucous membrane, but which, more or less broken up by the cancerous formations, remain attached, and hang flocculently from the ulcerating surface. In the other, dendritic villous processes, consisting of a delicate investing structureless membrane enclosing crowds of corpuscles—each villus supplied with a gigantic capillary loop—hang like plush from the surface of the altered mucous surface. In some

Fig. 72. Epithelial cancer of the lip. At the upper part, the angular margins rather too formal, as if done by a knife.

instances these nuclear developments invade only the submucous tissue ; in others, the muscular tissue is involved. They are, however, rarely connected with any actual tumour. They produce usually fatal results by capillary, but very copious hemorrhage.

Epithelial cancer admits of but one principle of treatment—early and free removal of the affected parts ; and this may be effected by knife or caustic, as circumstances may determine. When the lymphatics are affected, beyond the reach of either of these destroying agents, it is wise to abstain from all active interference ; unless, indeed, with a view to a merely temporary and palliative result—as in the case of the tongue. The patient may esteem it a great boon to be rid, even for a time, of the painful mass, with its foetid and loathsome discharge.

3. MEDULLARY CANCER.—The Encephaloid, or Cerebriform Tumour, the Medullary Sarcoma, the Cephaloma. There are other synonyms, but these are the most frequently employed ; terms originating in the likeness (to the naked eye) which the morbid product bears to the brain, in colour, texture, and consistence. The tumour may be from the first of this kind ; or a growth, originally simple, may have degenerated and assumed the medullary character. And it is to be remembered, that



Fig. 73.



Fig. 74.

when any tumour does degenerate into malignancy, it is generally the medullary structure and character which it assumes.

This tumour is highly vascular ; supplied and intersected by large veins ; and also not without its arterial nourishment. In this respect, indeed, all the malignant formations differ prominently from the benign. And in regard to tumours in general, there is good reason to believe, that the less the succulence and vascularity, not only the less rapid is the growth, but the less marked is the tendency to degenerate.

Section of a medullary mass displays a consistence, colour, and general aspect of structure somewhat like that of brain ; its vascularity is shewn by the open mouths of large veins, and other arborescent vessels. Pressure gives a large amount of the characteristic “cancer-juice.” The arrangement of the morbid mass is generally even and smooth. Micro-

Fig. 73. Medullary tumour beneath the mamma ; *a*, the tumour ; *b*, the mamma.

Fig. 74. Encephaloid tumour ; of especially evil mien ; at the lower part, bloody extravasation extensive.

scopically, it is found to consist of cells similar to those of the hard cancer ; but usually much more numerous, more loosely packed, and contained in a stroma more copious as well as less fibrous and firm. Hence the soft and yielding character of the growth. The cells may have every grade of development, from the earliest and youngest, to the retrograde condition. Sometimes the mass is found mainly to consist of cells remarkably elongated and caudate.

Sometimes it is surrounded by a cyst ; if so, this is usually imperfect, at one or more points, and there the tumour has plainly increased more rapidly than elsewhere. More frequently there is no envelope ; the surrounding textures having not been pushed aside, but involved in the structural change. It is not unusual, indeed, to find one or more dense fibrous bands intersecting the mass ; but these are not to be regarded as a part of the original tumour ; they are accidental, and owe their existence to the approach and union of two or more medullary masses, between which a part of the original textures, much condensed, still remains free from the medullary change. At first the mass is homogeneous. But after a time fatty degenerative softening occurs, at one or more points ; and there the consistence and colour resemble somewhat those of cream ; not unfrequently, however, of a much darker hue, by admixture of blood. Blood also is often found in bulk, not fluid, but coagulated ; and sometimes it is infiltrated diffusely throughout the morbid structure—signs always of evil omen, indicative of much malignancy, and an almost certain return.

In tumours of any considerable duration, cavities may always be expected, more or less numerous. They are of two kinds ; mere spaces, formed by softening of the medullary substance, and occupied by this softened matter variously mixed with blood ; or true cysts, lined by a secreting membrane, and filled with blood or with dark fluid, or with soft medullary matter. When the latter are found, the probability is that the tumour has been originally of the simply cystic kind ; that it has degenerated ; and that these cysts are remains of the original and non-malignant structure, not yet annihilated. In other words, it is believed that cysts lined by a secreting membrane do not enter into the original structure of medullary cancer.

So long as the tumour is invested by the integument, entire, it is said to be occult ; when the skin has given way, and the morbid structure consequently comes to be exposed, it is said to be in the open state. This opening is effected by ulceration of the skin, or other intervening texture, at the most prominent point of the swelling. In consequence of the elasticity of the morbid structure, a projection of the mass immediately takes place ; and this is increased by rapid growth at this point, where resistance has been removed. A fungus is speedily established ; of much the same texture as the general tumour ; but softer, and darker in colour, in consequence of atmospheric influence and admixture with extravasated blood. The surrounding integuments are without reparative effort ; ulceration extends in them ; and a foetid, bloody, thin fluid is profusely discharged. Sometimes the fungus sloughs, or crumbles away by softening and disintegration ; it is, however, quickly reproduced. Not unfrequently, a blood-vessel, probably one of the large veins, is opened into ;

and profuse hemorrhage results, of a dark unwholesome kind ; fearfully aggravating the prostration of system, which the previous state of the tumour had already begun.

In the open state, the nature of the formation is sufficiently plain ; in the occult, diagnosis is not always easy or sure. It is important, therefore, to be aware of the external characters, and other signs of the existence of the tumour, from even its earliest formation. Its growth is peculiar—most rapid ; in a few months, or even weeks, the size may have become truly enormous ; and very frequently a marked increase, day by day, may be observed. A fallacy, however, is liable to occur as to this point. A simple tumour, deeply seated, and tightly bound by fibrous investment, may simulate some of the characters of the occult medullary tumour very closely ; the surgeon, in doubt, manipulates it freely, and, for some time, perhaps daily ; he thinks he observes a marked and rapid increase of size, and by measurement or otherwise he may ascertain that such is actually the case. This last sign he may think conclusive, as to the medullary nature of the tumour ; and he may take his measures of treatment, according to that conviction. And yet, had he waited for a few days more, abstaining the meanwhile from further handling of the part, he would have found a subsidence of the increase in bulk, the tumour regaining its former dimensions. The temporary enlargement had resulted from the common products of simple inflammatory change, the consequence of manipulation.

The skin investing the tumour is generally pale, like that of a diseased and chronic articulation ; and usually shews many large veins coursing beneath it. Sometimes, however, the skin is of a brownish hue. At first, it is movable on the tumour ; afterwards intimately incorporated with it. The growth itself is not circumscribed and movable, as the simple formations, but fixed and diffused into the surrounding parts. To the touch a sense of great elasticity is imparted ; different from the fluctuation of chronic abscess, and different also from the semi-fluctuation which the fatty tumour exhibits, yet somewhat resembling both ; inso-much that it is not without the *tactus eruditus*—as well as attention to other signs—that the distinction can always be unerringly made. Occasionally, even the most experienced cannot be assured, until after an exploratory puncture. Perhaps they expected pus ; but nothing save blood escapes, and that profusely ; vascularity and elasticity are demonstrated, not fluctuation. Pain is almost always considerable ; often severe and shooting. In some cases, it is at first absent ; and then the tumour is usually slow of growth ; but when it enlarges in the ordinary manner, as it soon does, the pain becomes developed, and continues. The patient is obviously cachectic ; and bears in his countenance plain tokens of a formidable disease ; the features are shrunk and anxious, the hue is sallow, emaciation is begun, the functions of animal life are all disturbed, and hectic is setting in. While scirrhus is comparatively limited to advanced years, this disease is found to occur more frequently in the young ; children and adolescents are the ordinary victims. It may occur in any texture ; but is most frequent in the orbit, testicle, mamma, bones, joints, internal viscera, and lymphatic ganglia. In the two last situations, the formation is usually of a secondary character ; that is,

following on the appearance, or perhaps the removal by operation, of a malignant tumour elsewhere. For, as already observed, the disease extends not only by contiguity, involving the adjacent tissues, but also remotely by the lymphatics; and besides, the system being largely and specially involved—probably as the original part of the malady—there is the same predisposition to the morbid formation in one part as in the other; and often, coterminously with its external manifestations, the disease may be found reproducing itself, copiously, in one or more of the internal viscera. Sometimes the veins in the neighbourhood have been found filled with the medullary substance; but whether by simple extension of the tumour, or by conveyance of part of its substance, may be a matter of doubt. Pressure on veins and lymphatics occasions œdema of the parts beneath; compression of adjoining nerves creates intense pain, in addition to that which already existed as an inherent characteristic of the tumour. At first, the nervous trunks are expanded and stretched over the growth; ultimately they are involved in its structure. Occasionally, the disease has been found to extend by means of a nervous trunk; a tumour growing on it, at some distance from the original formation, and precisely of the same character. A medullary tumour involving the sciatic nerve, for example, has been followed by a growth of the same kind occurring in the popliteal.

It is plain that the only chance of cure is by extirpation, at a comparatively early period; when the tumour is small, not deeply or widely connected, the glands free, and the system making but little show of complaint. The dissection must be carefully and leisurely conducted, to ensure entire removal of the whole diseased structure; as the slightest portion left will certainly cause reproduction, rapidly, and of a worse tumour than the first. Smart hemorrhage is to be expected; not only from arterial branches, increased in size and activity, but also by oozing from the general surface. The muscles are usually of a pale and flabby character; sometimes at certain points, near the tumour, they are the seat of dark discoloration, as if by infiltration of blood. There is also a greater tendency to reactionary hemorrhage, than after simple wounds.

The operation having been suitably performed, the question of prognosis arises, as regards the probability of return; a question always of much doubt and difficulty; and never to be answered decidedly in the affirmative. Such a tumour, like a scrofulous swelling or sore, is in the great majority of cases to be viewed not as a disease in itself, but rather as a manifestation of a constitutional vice, from which other tumours may arise of a similar nature, in the vicinity of the first formed, or elsewhere. In both cases there is a cachexy, constituting the major part of the evil. That of scrofula is but little amenable to treatment; the malignant and medullary is still less so. And unless that cachexy be removed—an object in this disease unattainable—there can be no certain immunity from return. Our duty, however, is very plain; to operate, carefully, in those cases of recent and limited tumour, the circumstances of which seem favourable to success; to refrain from operation in those advanced cases, where not only deep and important parts are involved, but where both the lymphatic and general systems are plainly implicated, and where consequently reproduction is certain; and in all cases to

express our prognosis in the most guarded terms. Perhaps the situation most favourable to non-return, after timeous and skilful operation, is the testicle.

Reproduction occurs either in the original site or elsewhere. A medullary tumour having been removed from a lower limb, for example, we apprehend return not in the stump alone, nor in the groin, nor in any part of the external surface; but are anxious in regard to symptoms of internal mischief, by formation of medullary masses in the liver, kidneys, or lungs. The internal reproduction is perhaps the most common; but not unfrequently, the return is on the surface as well. As already stated, bloody masses and infiltrations, shewn in a section of the original tumour, are declared by experience to be ominous of return. And under whatever circumstance this does take place in the original site, the secondary formation almost invariably shews an aggravation of progress and malignancy; probably in consequence of increase of the cachexy, which the untoward effect of the previous operation has induced.

Molluscous tumours of and beneath the skin, occurring in great numbers over the general surface, not unfrequently present all the characters of the medullary formation. Such cases are obviously hopeless. Operation is unwarrantable, and we must content ourselves with palliation.

4. MELANOTIC CANCER.—The abnormal presence of pigmentary matter of black or brownish colour, in various organs or tissues, is not necessarily connected with malignant disease. A common form in which it occurs, is in the lungs; where it constitutes a species of spurious melanosis, dependent on the infiltration of carbon into the tissue. With this we have nothing to do. The pigment which enters into the formation of tumours is of a different character; it is in some way formed from the blood, like that of the choroid coat of the eye, and, unlike the carbonaceous pigment, is readily decomposed by nitric acid, with the aid of heat. It forms brownish or black granules under the microscope, tending to the angular form, and of very various size—from the minutest molecule to the size of a blood-corpusele. When this pigmentary matter occurs in a distinct tumour, and is infiltrated into its cells, we have the disease at present under consideration; which must not be confounded with those dark-coloured deposits which take place in many textures, without tumour, and without any other alteration of nutrition. Even as tumours, melanotic formations are found in the lower animals—more especially the horse—with little if any tendency to malignancy.

In man, like other tumours, it is the result of perverted nutrition; a thorough change of structure. Perhaps its most common nidus is the

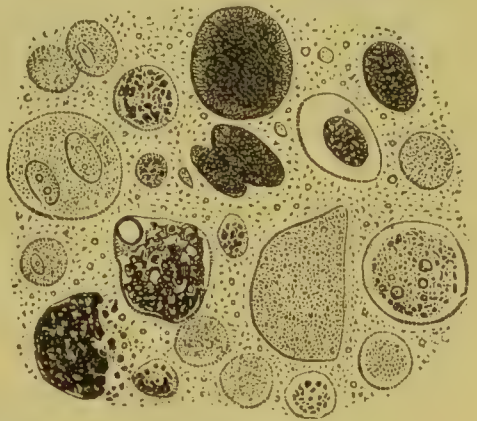


Fig. 75.

Fig. 75. Cells more or less loaded with black pigment, from a melanotic tumour of the cheek.—BENNETT.

connective tissue connected with the serous membranes, and with the skin. Sometimes it is pure ; more frequently it is complicated ; and the morbid structure with which it is most frequently associated is the medullary. The external surface is of a shining and mottled appearance ; the form is more or less globular, and lobulated ; the size is seldom great, rarely indeed exceeding that of an egg ; often inconvenience is slight, and scarcely amounts to pain. The dark colouring matter is itself non-vascular. The stroma, in which it is imbedded, is fully vascularized ; fibrous in character, and containing, as seen under the microscope, the ordinary varieties of the cancer-cell. The most frequent site is in the globe of the eye ; usually connected with medullary formation ; and perhaps the frequency of this site may be connected with the normal pigment of the choroid coat.

The melanotic growth, when situated externally, follows the ordinary course of the "tumor mali moris ;" involves the skin, ulcerates, and discharges black matter, with a fœtid sanious secretion. And by this time usually, the medullary structure has also been developed ; giving to the sore more or less of a fungating character ; involving the system in the wonted cachexy ; and dragging the surrounding parts into rapid assimilation of structure. The melanosis, though doubtless in itself neither simple in structure nor benign in tendency, yet is to be regarded as malignant chiefly on account of that tendency to associate with a more sinister formation, which it so strongly and almost invariably manifests. It seldom occurs but in those of mature age ; therein differing markedly from the simple cephaloma. A constitutional vice, doubtless, accompanies ; but not so intense in itself, nor so obvious in its indications, as in the other malignant tumours ; unless with one or other of these the melanosis be primarily combined.

There is no hope of cure, but from free extirpation by the knife ; and that at an early period, ere the medullary complication have begun to form. Return, under such favourable circumstances, is less likely than in any other malignant disease. When complication has occurred, with either the scirrhus or the medullary formation, the minor is to be regarded as merged in the greater evil ; and the rules of treatment are to be enforced, as if the case were one of scirrhus, or of medullary tumour, alone.

5. COLLOID OR ALVEOLAR CANCER.—This is a disease more important to the physician than to the surgeon ; but as it sometimes occurs in the bones, mamma, and other external organs, it will be proper to give some account of it.

In colloid cancer (*κόλλη*, glue), the meshes of the tumour are filled up by a matter like gelatine or half dissolved gum-arabic (half-set glue, half-trembling jelly), colourless, or of a slightly yellow hue, and to the naked eye conveying the impression of being devoid of all structure, but containing numerous microscopic cells, which present the usual characters of malignancy. Sometimes the colloid matter occurs in large masses, with very little intervening fibrous tissue ; sometimes, too, the cells are in small amount. Occasionally it occurs in cysts ; and in this case is very doubtfully, if at all, cancerous. When, on the other hand, it forms, as in the mamma and sometimes in the liver, in meshes composed of a tissue

having every other characteristic of cancer, there can be no doubt as to its true nature.

The surgical management of colloid cancer has nothing peculiar ;

Fig. 77.

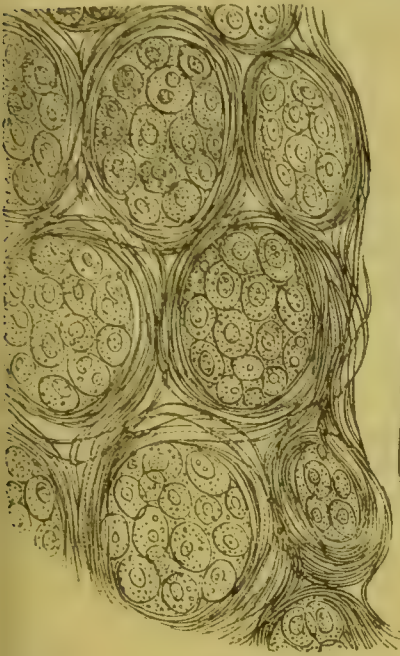


Fig. 76.



Fig. 78.



Fig. 79.

being guided by the same principles as in any other malignant growth.

6. FUNGUS HÆMATODES.—This is a compound morbid state ; generally arising out of the medullary tumour, when in the open and ulcerating condition. It has already been stated that protrusion of the medullary mass, and infiltration of it with extravasated blood, are liable to occur under such circumstances. But in order to constitute a true Fungus Hæmatodes, three things are essential ; that there shall be a fungous projection of morbid structure ; that the fungus be dark and bloodlike ; and that it bleed, more or less profusely. This condition may be either of a primary or of a secondary character ; much more frequently it is the latter. Examples have occurred in which, without other morbid formation, a small, dark fungus has shewn itself, bleeding profusely from time to time, perilling life, and demanding the most urgent measures for its removal. But, more frequently, there is first a tumour of malignant character, which opens, and ultimately throws out the bleeding fungus ; and the fungus hæmatodes, in this, the most frequent case, is to be regarded as the climax of malignancy in a formation already of evil nature. The morbid structure on which it most frequently supervenes, is the medullary. The untoward symptoms are all much aggravated by the accession ; the cachexy becomes more marked ; the frame sinks lower and more rapidly ; the malignant hectic has an acute exacerbation ; pain and misery are great ; exhaustion is rapid ; and fatal sinking is not long deferred.

Fig. 76. Section of colloid cancer from the stomach, shewing the loculi in the fibrous structure and the contained cells.

Fig. 77. Several cells isolated.

Fig. 78. Fibrous stroma deprived of the cells by pressure and washing.

Fig. 79. Section of the growth treated with acetic acid.—BENNETT.

In tumours, there may be two steps of degeneracy ; from the simple structure to the medullary ; from the latter, to the condition of fungus hæmatodes. But, usually, the medullary formation, from which the bleeding fungus springs, is of primary origin. All medullary tumours, when open, tend to fungate ; but all medullary fungi are not entitled to the appellation of fungi hæmatodes. It is easy to understand, however, how the hæmatoid condition should not unfrequently occur ; by softening and breaking down of the medullary texture, whereby one or more of the large vessels found permeating such growths are opened into. A detached portion of the medullary mass, or a fresh protrusion, may temporarily occlude the aperture ; but, in its turn, it crumbles away, and the bleeding recurs. The part is obviously incapable of adopting the ordinary natural hæmostatics.

This is the most malignant of all morbid structures, and little amenable to treatment. There is no hope but from early removal by the knife ; and, in most cases, amputation of the member is preferable to excision of the part. But do what we will—however early, however

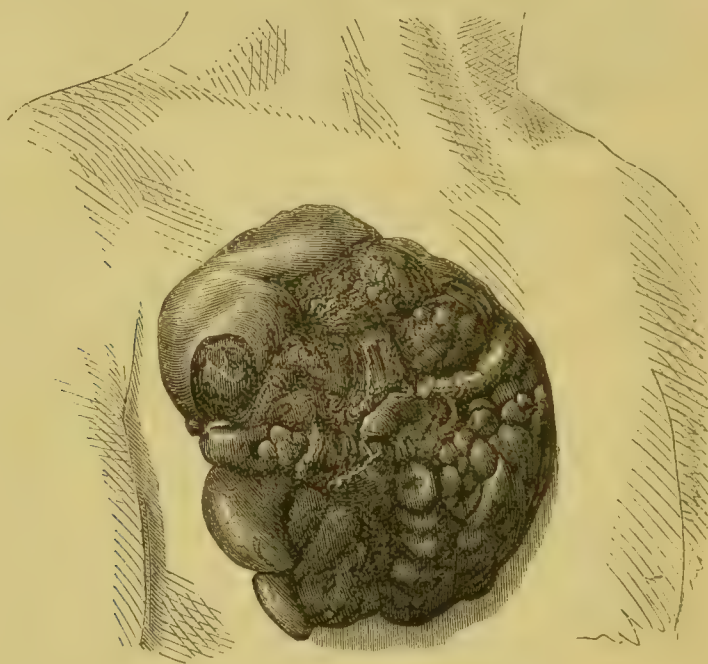


Fig. 80.

summarily—too generally the disease returns, and the patient falls its victim. And when we consider that the greater number of cases are merely the advanced stage of medullary cancer, we can readily understand how the experienced and judicious surgeon, encountering an example of fungus hæmatodes, often finds himself constrained to non-interference, and has to content himself with palliating what he cannot cure.

Before leaving the subject of tumours, it may be well to make some general observations on their removal by the knife.

Sometimes, even the most experienced are in doubt as to the exact

Fig. 80. Fungus hæmatodes. Fungoid, bleeding, and bloodlike. From the mamma.

nature of a swelling ; whether it is a solid tumour, tense, and very elastic ; or a cystic formation, partly solid and partly fluid ; or a mere accumulation of purulent or puriform matter. It were a great mistake to plan and commence extensive incisions, for what required only a trifling puncture. And in order to guard against such an accident, the thrust of an exploratory trocar or needle may sometimes be expedient ; an ordinary trocar, of small size ; or a rather large needle, grooved on one side, so as to permit free lateral escape of fluid.

But such exploration is by no means so light a matter as some would seem to consider it. It is not warrantable to plunge a trocar into any and every tumour, of whose nature there may be some doubt. If it be an abscess, no harm ensues ; the puncture is immediately enlarged, for the purpose of due evacuation. If it prove to be a solid growth, there still may be no harm ; provided patient and surgeon are prepared at once, or at all events within a day or two, to proceed to extirpation. But much injury will not fail to result, if, after puncture, the tumour be left to itself for some considerable time ; and, more especially, if absurd attempts be made, by stimulation, to effect its removal by absorption. There is no more sure exciting cause of a tumour's degeneration, than the thrust of an exploratory trocar. On a section being made of the mass, after ultimate removal, the origin of the structural change may not unfrequently be seen in the instrument's track. While, therefore, exploration is expedient to guard against error of diagnosis which otherwise might occur, and which might lead to serious error in practice—its use ought to be limited to very doubtful cases, in which other means of diagnosis, patiently and skilfully used, have failed to satisfy ; and not even in such cases should it be had recourse to, unless early operation, if not immediate, have been determined on, in the event of the swelling being proved to be an undoubted and undiscussible tumour.

As a general rule, the line of incision should be parallel to that of the adjacent muscular fibre ; for then the wound will be more easy of coaptation, and consequently more capable of adhesion. But to this there are exceptions. When important blood-vessels or nerves are concerned, we cut in the line of their course ; and so run less risk of injuring them. In the forehead and face, we often cut almost transversely to the line of muscular fibre ; finding it to be of more importance, as regards both subsequent deformity and immediate coaptation, to be in the line of habitual integumental folds—the result of muscular action. It will be afterwards seen that, in the case of deep exostosis, it is also expedient to place the wound not altogether in a line with muscular fibre.

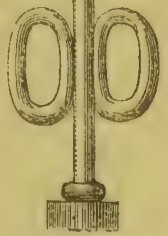


Fig. 81.

Fig. 81. Exploratory trocar and canula ; of sufficient length to reach suspected collections in the deep cavities.

The external incisions should be always free ; rather too extensive than otherwise. For thus both facility and safety of dissection will be materially favoured. Besides, an excavation, with but a narrow integumental orifice, is much more likely to prove troublesome by suppuration, than a more extensive yet simple wound, whose largest dimension is superficial.

Integumental incisions are much facilitated, by previous tension of the skin. But, when certain lines or points are important guides to the relative anatomy of subjacent parts, care must be taken, while stretching, not to displace them.

The incisions should commence where the principal blood-vessels and nerves enter ; advancing steadily from that point. The nerves are cut at once, and thus the subsequent dissection becomes comparatively painless ; even independently of chloroform. The arterial trunks, too, being cut early, and compressed or tied as soon as cut, the operation in consequence is comparatively bloodless. Following an opposite course, an unnecessary amount of blood is lost, and the number of ligatures is great.

Unless hemorrhage be very alarming, or the patient be already so sunk by disease as to be incapable of bearing loss of blood, deligation of the cut vessels should be reserved till after the tumour's removal ; temporary arrest being entrusted to the fingers of an assistant. Thus, time is saved. And the number of ligatures will also be diminished ; it being likely that some of the smaller branches—important enough to have demanded deligation, at the time of their section—will be found satisfactorily closed by completion of the natural hemostatics, assisted by the temporary pressure.

A tumour placed over the course of large nerves, blood-vessels, or other important organs, may seem to be completely separate from them. Yet in many such cases the operator finds, during his dissection, that his previous examination has, to a certain extent, deceived him ; the prolongations, even of a simple tumour, often extending to a much greater depth than was externally indicated. On the other hand, a large artery or nerve, passing through a tumour, may seem to be irrevocably incorporated with its structure ; yet, if this be not malignant, the artery or nerve so situated is not to be rashly sacrificed in the operation. They may pass innocently through without being implicated in the structural change ; and a careful dissection may leave them intact, yet without any portion of the tumour adherent.

Let dissection advance regularly, from one aspect of the tumour to another ; and not by alternate cuts, or scratches, at various points. The procedure will thus be more seemly, simple, and safe.

In removing benign formations, firm, and circumscribed, from the vicinity of important parts—as blood-vessels, nerves, cavities, and canals—let the knife's edge play closely on the tumour, each stroke telling on its surface ; and, by traction on the tumour, remove it at the same time as far as possible from the contiguous parts. Thus the latter are saved ; while, at the same time, we can make sure that the whole of the diseased formation is taken away. But if the tumour be either avowedly malignant, or suspected of evil tendency, the incisions must be conducted on a precisely opposite principle. If the adjacent parts be such as not to

admit of free cutting around the tumour, refrain from operation altogether. And, in all practicable and expedient cases, cut away from the tumour rather than on it. For, as already stated, unless a border of apparently sound texture be taken away, along with the tumour, we can never be certain but that many germs of the disease are left behind, rendering reproduction inevitable.

The operator should never be in a hurry. If hemorrhage is troublesome, it can always be restrained either by pressure or by ligature. Hasty play of the knife, in the case of a simple tumour, may endanger important parts; which ought to have remained untouched. In the case of a malignant formation, there is not only the same danger, but a greater; there is the risk of leaving a portion of the morbid structure unremoved. In any operation, haste is inexpedient; here it is highly culpable. The knife should proceed leisurely; following the eye and finger, if need be. And, to make certain of entire removal, the extirpated part should be carefully examined at its cut margin—as well as the surface of the remaining wound—to see that no suspicious texture has been cut through, instead of having been cut away. If an unsatisfactory portion be detected, this must at once be carefully dissected out; and, not until thus assurance has been made doubly sure, should coaptation be effected.

Operating in the axilla, or at the lower part of the neck, the larger veins, should be interfered with as little as possible; tension of vascular parts, previous to incision, should be avoided; and the other means should be taken, which tend to obviate the accidental entrance of air into the veins. It is during the dissection of deeply-seated tumours, in such localities, that this casualty is most liable to occur.

Some pendulous tumours, of a narrow pedicle—as certain of the adipose—enlarge greatly in their free portion, and cover a large extent of surface. It is well, in such circumstances, first to amputate this pedicle, on a level with the surrounding skin; in order thereby to facilitate extirpation of the remainder. Pendulous tumours, sometimes, by their own weight, withdraw their deep attachments—which become more and more superficial; and in such cases, artificial traction may be made to assist the natural tendency—rendering the subsequent operation comparatively easy and safe.

Deep walls of fat are inimical to adhesion of a wound. Therefore, in operating on subjects of obesity, it is advisable to remove a suitable portion of the subcutaneous fatty texture along with the tumour, by inclining the knife to the required extent.

In extirpating malignant tumours, especially the scirrhus, we have to avoid both too sparing and too free removal of the integument. If over-anxious to have an easily coaptated wound, we may spare skin already involved; rendering reproduction certain. And, on the other hand, if much skin be sacrificed, reproduction will also be favoured; by tightness and irritability of the cicatrix. When in doubt, it is well to err on the safer side; making every consideration secondary to thorough removal of the diseased parts.

When a large and deeply-seated tumour involves difficult and dangerous dissection, this may be facilitated by removal of the principal part of

the growth first exposed ; and simple bisection of it may sometimes answer the same end. Also, when the knife has gone as deeply, or as near to important parts, as seems consistent with safety, the remainder of the tumour—if simple—may be treated by ligature ; as in the removal of central bronchocele, whose increase is interfering seriously with respiration. And if on separation of the ligature, a portion seem still to remain, this may be dealt with by caustic.

In the case of hopeless tumours, which preclude all attempts at extirpation, by their extent, vascularity, and important connections—and which at the same time threaten death, while yet occult, by interference with important functions—life may be prolonged and suffering alleviated, by division of external parts so as to relieve tension and permit freer outward growth. In large bronchocele, threatening asphyxia, for example, it may be expedient to divide the sterno-cleido-mastoid muscles, and perhaps also the cervical fascia, subintegumentally.

Of late a comparatively bloodless method of removing tumours has been introduced by M. Chassaignac, by means of an instrument named the *ecraseur*. A loop of a fine steel chain, in short links, is carried round the base of the tumour—the body of this having, if need be, been previously elevated by means of a hook or forceps, so as to admit of thorough inclusion ; and by working the handle of the instrument at short intervals—a few seconds each—the noose is tightened, so as not only to strangle the mass, but remove it absolutely. But little blood escapes, and the whole proceeding, though necessarily tedious, may be less formidable to some patients than the use of the knife ; the remaining wound, too, is likely to be of no great size. But it is a bruised wound, and therefore prone to inflammatory accidents ; and, as in the case of caustics, there must often be more or less uncertainty as to the exact amount of texture, normal and abnormal, that is removed. In short, the process is less speedy and less certain than incision ; yet is a good substitute for this, in localities where troublesome bleeding might otherwise be expected, and in the case of patients who might scarcely be brought to submit to any other mode of procedure. The operation is an extremely painful one, and requires the administration of chloroform.

CHAPTER VIII.

SCROFULA, AND TUBERCULAR DISEASE.

The term Scrofula is usually applied to a constitutional affection, occurring for the most part in early life, of essentially chronic development, and characterized by a tendency to various destructive diseases of the bones and joints ; often accompanied by enlargement of the lymphatic glands, and by disorganizing affections of the skin and mucous membranes—these occurring either separately or together, and without obvious or adequate exciting cause. Under this somewhat comprehensive definition, it is obvious that a great number of different local disorders may, and indeed must, necessarily find a place ; and we accordingly have the term scrofula, and scrofulous disease, applied by many writers to types of local affection which are only very indistinctly, if at all, connected with a constitutional cachexy. In the absence of more unequivocal signs of constitutional disorder (such as extensive involvement of the lymphatic system), it is therefore almost essential to the idea of scrofula, as we have defined it, that there be an association of a number of maladies, pointing to a vitiation of the general system as their common cause. This rule, however, only applies to the well-developed affection ; for, in its early origin, a single local disorder not unfrequently presents such characteristic symptoms, as enable the experienced practitioner to judge with tolerable certainty of the existence of the yet latent constitutional evil.

The frequent association of scrofula with a peculiar form of morbid product, has been long observed. This formation, which will presently be described under the name of *tubercle*, occurs very frequently in enlarged lymphatic glands ; leading to a slow process of suppuration and ulceration there. It may also affect various internal organs, as the lungs, brain, intestinal and mesenteric glands ; in which situations it proves the source of various destructive diseases. We cannot, however, limit the term scrofula, as some have done, to disorders arising from tubercular formation ; inasmuch as most affections of the skin, mucous membranes, and joints, in scrofulous individuals, have no such origin. Nor, on the other hand, can it be admitted that tuberculization of the internal organs, at least in adult life, is always, or even generally, a disease of the scrofulous habit. All that can be fairly said is, that tubercular disease of the external glands is a frequent concomitant of scrofula ; as is also a similar affection of the mesenteric glands. And that, in a certain indeterminate number of instances, tuberculization of internal organs follows, or accompanies, the characteristic evidences of scrofulous disease ; while, in others, it is quite an independent affection. Still, however, as most of the forms of tubercular disease which come under the notice of the surgeon are

distinctly scrofulous, it is requisite to treat of these affections under one head.

This cachectic tendency is either hereditary or acquired. Frequently it may be traced descending from parent to child, from generation to generation. But, on the other hand, a child may be born, itself in all respects healthy, and of healthy descent both immediate and ancestral, and yet in the course of years come to shew all the signs of a confirmed strumous diathesis. The circumstances likely to induce the unhappy change are those of a peculiarly debilitating tendency; exposure to atmospheric vicissitude, by insufficient clothing and shelter; improper and scanty food; lingering and wasting disease; imprudent use of mercury, especially in tender years; excessive labour, mental or corporeal; and habitual deprivation of healthful air and exercise. Or again, such events may not be the means of inducing this disorder in a frame previously healthy; but only the direct and exciting causes of it, in a system already predisposed by hereditary taint. The disease is not communicable by contagion or inoculation, as has been proved by direct experiment; and it is found to prevail more in temperate climates, as this, than in either the extremely hot or cold—variability seeming to be especially favourable to its accession. It is also more frequent in towns than in the country; as are all other diseases of debility. Males are more liable to external scrofula than females; while these, on the other hand, are more subject to phthisical disease. The especial period of accession, even in those in whom the tendency is congenital, is between the ages of three and seven years; but, indeed, the whole period of adolescence is favourable to its occurrence, the normal balance of health being then more easily deranged by accidental circumstances than at a more mature age. In those of confirmed scrofulous habit, the tendency to development of disease varies also according to season. Spring is the period of exacerbation; more especially the month of March. This month is supposed to represent the maximum of the crisis; January and June its extremes of accession and decline.

The disease may be evinced by outward signs; and these have been supposed divisible into two distinct varieties, according to temperament; the sanguine and phlegmatic. According to some, however, such artificial division is scarcely warranted by an extended observation of the disease; which is found to occur in all temperaments, and in almost all states of the system.

In the sanguine variety the complexion is fair, and frequently beautiful, as well as the features. The form, though delicate, is often graceful. The skin is thin, of fine texture; and subcutaneous blue veins are numerous, shining very distinctly through the otherwise pearly white integument. The pupils are unusually spacious; and the eyeballs are not only large but prominent, the sclerotic shewing a lustrous whiteness. The eyelashes are long and graceful—unless ophthalmia tarsi exist, as not unfrequently is the case; then the eyelashes are wanting, and their place is occupied by the swollen, red, unseemly margin of the lid.

In the phlegmatic form, the complexion is dark, the features disagreeable, the countenance and aspect altogether forbidding, the joints large, the general frame stunted in growth, or otherwise deformed from its fair proportions. The skin is thick and sallow; the eyes are dull, though

usually both large and prominent ; the general expression is heavy and listless ; yet not unfrequently the intellectual powers are remarkably acute, as well as capable of much and sustained exertion. The upper lip is usually tumid, so are the columna and alae of the nose, and the general character of the face is flabby ; the belly inclines to protuberance ; and the extremities of the fingers are flatly clubbed, instead of presenting the ordinary tapering form.

In 1859 Mr. Jonathan Hutchison pointed out certain characteristics of external aspect which marked hereditary syphilis as a common cause of diseases which till then had been reported strumous or scrofulous. In a recent work he says, "A peculiar physiognomy, of which a coarse flabby skin, pits and scars on the face and forehead, cicatrices of old fissures at the angles of the mouth, a sunken bridge to the nose, and a set of permanent teeth peculiar for their smallness, bad colour, and the vertically notched edges of the central upper incisors, are the most striking characters."*

The characters of the scrofulous diathesis are accompanied by others, referrible to the internal organs ; and which, though not distinctly morbid, generally indicate the approach of the disease. Digestion is weak and imperfect ; and this is indicated, as usual, by abnormal states of the tongue and bowels. The muscles are soft, flabby, and weak ; the blood is thin and watery ; the general circulation denotes debility, and is liable to oft-recurring derangement ; the extremities are cold ; and in short there are a greater or less number of the usual indications of want of tone, and general weakness.

Added to these signs, there are oft-recurring morbid conditions, which, although not individually of great importance, yet serve collectively to point out the general functional disorder. The mucous membranes are very liable to derangement ; there are frequent discharges from the nose, ears, or eyes ; the tonsils become enlarged ; and the air-passages inflame from the slightest causes. The stomach and bowels are more and more disordered ; the tongue is generally foul ; the cutaneous perspiration is said to be unduly acid, and loaded with sebaceous matter. All morbid actions, too, are apt to assume a chronic and obstinate type ; very different from what is observed in the healthy individual.

As the disease makes progress, the cervical glands commonly become swollen ; the mesenteric glands also are more or less affected ; and tumidity of the abdomen increases. The enlargement of the cervical glands is at first perfectly painless, and without any mark of inflammatory change. Afterwards, however, a low form of this attends the progress of the swelling ; and an abscess is slowly formed, with some degree of redness, pain, and heat of the part. The tumour enlarges and softens, presenting a rounded surface ; not conical, as in the acute abscess. The skin, if not opened with the knife, soon ulcerates : and a discharge of yellowish, curdy, semi-fluid matter takes place, which consists of pus mixed with the peculiar matter of tubercle. The ulcer thus formed is slow to heal. Its surface, of a yellow or pale-red hue, after a time produces granulations ; tall, few, pale, flabby, lowly organized and vascu-

* A Clinical Memoir on certain Diseases of the Eye and Ear, consequent on inherited Syphilis. By Jonathan Hutchison, F.R.C.S., London.

larized, possessed of but little sensibility, and not effectual towards cicatrization. Closure advances tediously and imperfectly; is long of being completed; and, when completed, is unstable and unsatisfactory. The cicatrix is blue, soft, and liable on the least reaccession of the inflammatory process to be undone by ulceration; the ulcerous part has been covered over by a film, but not truly healed, for so long as any tubercular matter remains undischarged, it is incapable of producing a permanent and satisfactory cicatrix—white, firm, and depressed. To effect this, the tubercular material must be removed, by the act either of the surgeon or of Nature*—by caustic, or by spontaneous disintegration; on a firm foundation alone can the true reparative structure be raised.

Even when an apparently satisfactory cicatrix has been obtained, the cure is not to be regarded as complete; for if the constitutional vice remain unremoved, as too frequently is the case, disease is likely to return in the original site, as well as elsewhere. In treatment, therefore, our attention must be directed fully more to the system than to the part; and also, the constitutional care must be maintained long after healing of the local disorder.

The most serious complications of scrofulous disease, however, which come under the care of the surgeon, are the affections of the bones and joints. They generally arise from slight injuries; but still the result is very much out of proportion to the cause. They are sometimes of a peculiar character; but frequently do not differ essentially from ordinary inflammatory affections, except in being slower in progress and more obstinate in cure. The affections of the eye and skin, in the scrofulous, are also peculiar; and, with the others, will be adverted to hereafter.

Tubercle, the morbid formation so often found in scrofulous glands, as well as in internal organs, is a substance presenting very imperfect organization. In its most recent form, it consists of small, rounded granules or knots, each not larger than a pin's head. This constitutes a new formation produced by the proliferation of the connective tissue, and consists, throughout its whole mass, of small single or many nucleated cells. At its commencement, like other new formations, it is not unusually pervaded by vessels; but when it enlarges, its cellular constituents throng so closely together, that the vessels become impervious, and only the larger ones, which merely traverse the tubercle, remain intact. Generally, fatty degeneration sets in at an early period in the centre of the tubercle, where the cell multiplication first began, and where, therefore, the oldest cells lie. Then reabsorption of the fluid commences, the corpuscular elements shrivel, the centre becomes yellow and opaque, and a yellow spot is seen in the middle of the grey translucent tubercle. This is the

* "By Nature I always mean a certain assemblage of natural causes, which, though destitute of reason and contrivance, are directed in the wisest manner, whilst they perform their operations, and produce their effects. Or, in other words, that Supreme Being, by whose power all things are created and preserved, disposes them all in such manner, by His infinite wisdom, that they proceed to their appointed functions with a certain regularity and order, performing nothing in vain, but only what is best and fittest for the whole frame of the universe, and their own peculiar nature; and so are moved like machines, not by any skill of their own, but by that of the artist."—*Sydenham*.

commencement of the cheesy metamorphosis of the product. The change advances further and further outwards, till usually the whole formation is involved in it.

The tubercle never attains any considerable size. The large tubercular masses which are sometimes met with—as, for example, in the brain, of the size of a walnut, in the pleura like large yellow masses—are not simple tubercles. Every such tubercular mass consists of thousands of tubercles; in fact, it is a nest of them, and enlarges, not by the growth of the original *focus*, but by the formation and addition of new miliary tubercles at its circumference.

The cheesy transformation by which the tubercle is disintegrated, although the usual, is not the only termination of the product; in rare cases, by complete fatty metamorphosis, it becomes capable of reabsorption. Again, many so-called tubercular infiltrations, or even tubercular knots and deposits, are undoubtedly nothing more than the inspissated results of a preliminary inflammatory process. Tubercular matter, constituting the curdy or flaky substance of chronic abscesses, or adhering to the remains of the vertebræ in Pott's disease, or occupying in part the sac of the pleura, are examples on the large scale of such an imperfect reabsorption of pus.

In the history of pulmonary tuberculosis, this is what occurs:—shrivelled up cells, like those enclosed within the alveoli of the lungs, become inspissated in one alveolus after another, extending in gradual onward progress till a cheesy hepatization is produced, such as is usually described under the name of tubercular infiltration.

The nature of tubercle cannot be studied after it has become cheesy, for from that time its history is identical with that of pus which is becoming similarly affected.

In the lymphatic glands, tubercles are always of an opaque yellowish colour, and disposed to soften; in the lungs, and other organs, they are sometimes pearly or semitransparent, and of considerably firmer consistence. The masses enlarge, and become confluent; at the same time softening, and assuming a yellower appearance. Finally, a considerable portion breaks down into the flaky and curdy pus before mentioned, and is evacuated.

When microscopically examined at an earlier period, what especially characterizes this formation is the abundance of nuclei, so that, when examined as it lies imbedded in the tissue by which it is surrounded, there seems to be nothing but nuclei. But upon isolating the constituents of the mass, either very small cells provided with one nucleus, often so small that the cell-wall closely invests the nucleus, or larger cells with a multiple division of the nucleus, are observed. In the latter case, from twelve to twenty-four, or even thirty nuclei, may be contained in one cell; these nuclei are, however, always small, and have a homogeneous shining aspect.

This structure, which in its development is comparatively most nearly related to pus, in so far as it possesses the smallest nuclei, and relatively the smallest cells, of any morbid formation—is distinguished from all the more highly organized forms of cancer, canceroid, and simple tumours, by these containing voluminous, nay, often gigantic corpuseles, with

multiple and highly developed nuclei and nucleoli. Tubercle, from its commencement, is, in fact, a poor, puny effort at cell proliferation ; and in its cell elements more closely resembles the corpuscles of the lymphatic glands than any other of the normal tissues of the body.—(*Virchow.*)

In the internal organs, true tubercular formations do not differ materially in constitution from those in the external lymphatic glands. In both situations their progress is usually the same ; it is, however, to some extent modified by the nature of the part wherein the tubercular matter is formed. In the lungs the masses of tubercle seldom attain a considerable size without softening ; and as the debris of the softened tubercles is discharged by the bronchi, along with the remains of the pulmonary tissue, an ulcerous excavation results, which is usually called a vomica, or tubercular cavity. These excavations are generally formed first at the upper part of the lung ; they are seldom isolated, and often break into one another, causing by their rapid extension hectic fever, copious expectoration of pus, often considerable hemorrhage, and finally death, either by long-continued exhaustion, or by some accidental inflammatory complication. This production and excavation of tubercular formation in the lungs forms the chief feature of the disease known as phthisis pulmonalis, which is not unfrequently developed at all ages before the middle period of life, in persons in whom the scrofulous taint is strongly marked, as well as in many others who have given no external indications of this constitutional condition.

In the mucous membrane of the intestines tubercles are very frequently found ; and by their softening and disintegration open ulcers are produced, which in the great majority of cases undergo progressive extension, and by producing diarrhoea contribute greatly to a fatal result. Intestinal tubercles are commonly formed secondarily to those in the lungs ; and are often accompanied by a tubercular state of the mesenteric absorbent glands.

In the serous membranes, especially the peritoneum and pleura, tubercles not unfrequently form ; and in these situations they have little tendency to soften and ulcerate, as in other parts of the body above mentioned. The destructive tendencies of tubercles in the serous membranes arise from their being accompanied by chronic inflammatory products, which may either be fatal directly by interfering with the functional activity of important organs, or indirectly by exhaustion and fever.

In the brain and its membranes, tubercles occasionally soften and form abscesses ; more commonly, however, they are fatal at an early stage of their development by interference with the functions of the organ, and in the majority of cases by serous inflammatory product in the ventricles, or hydrocephalus. This form of tubercular disease is most common in infants and young children.

In the internal, as in the external parts of the body, tubercular formations not unfrequently heal, or become inactive. The healing process is always slow ; and after ulcers have been formed, or tubercles have been extensively produced, it is very uncertain ; a stationary or retrograde condition of the affection being often followed by renewed activity and

progress. The healing process is rarely, if ever, accompanied by resolution or absorption of the tubercular masses, although these may totally disappear from the tissue by ulceration, and be eliminated from the system. More commonly some of the tubercular masses are found to remain, even after an apparently perfect cure of the affection, in the form of hard, gritty, or chalky masses, generally surrounded and separated from the normal tissues by a fibrous cyst; and these bodies, although quite unorganized, may lie latent in the organs for an indefinite period without giving rise to any inconvenience. It is well ascertained also that tubercular excavations in the lungs, even when of large size, occasionally heal, either by gradual contraction and obliteration, leaving a fibrous cicatrix; or by the formation of a smooth lining membrane, continuous with that of the bronchi, and resembling, in some degree, the structure of a mucous membrane.

Of all the forms of internal tubercle, that of the lungs is the most frequent and the most extensively fatal. It is not common, however, for tubercles to be present in one organ without the participation of others in the morbid condition. And the surgeon will do well to keep this in mind when called upon to treat external scrofulous affections; especially if severe operations are required. Many a patient has suffered amputation of a limb, or excision of a joint, in whom the external and more apparent disease was the least part of the affection, and in whom the constitution, enfeebled and destroyed by a wide-spreading disorder, was little adapted to bear the shock of an operation. It should therefore never be forgotten that, in adults, tubercle very seldom manifests itself in any part of the body without the lungs being affected; while in infants or children, the lungs, bronchial and mediastinal glands, intestines, mesenteric glands, and the brain, are frequently the seats of this morbid change, which in any or all of these situations may be pursuing its destructive course while the careless or ignorant surgeon is fixing his whole attention on a gland or joint.

Treatment of Scrofula.—This is both local and constitutional; the latter the more important, as already stated. In most diseases, and especially in this, prevention will be found better than cure. When a child, therefore, is born of strumous parents, all those circumstances formerly noticed as likely to induce development of the disease, a tendency towards which is presumed to be congenital in the patient, should be most carefully avoided. And, in accordance with the view taken of the cause of the depraved tendency or state of system, it is plain that the line of treatment, whether preventive or curative, should be tonic. This best consists, not in medicine, but in due regard to food, bowels, skin,



Fig. 82.

Fig. 82. Portion of tuberculated omentum.

air, exercise, and climate. The food should be in sufficient quantity, generous and nutritive, yet simple, and not in such amount as to exceed the power of digestion. The bowels should be kept in a regular and normal state, by attention to diet and exercise; assisted, if need be, by simple laxatives; purgatives, and more especially mercurials, being avoided, unless in urgent circumstances. Mercury, which in the diseases resulting from hereditary syphilis works magical results, is justly held to be injurious in the scrofulous diathesis, more especially when used so as to produce its constitutional effect; except when acute inflammatory change has seized upon an important and delicate tissue; and even then it must be used warily—for scrofula greatly modifies that tolerance of the remedy which the inflammatory attack would otherwise engender. Purgatives, on the other hand, are dangerous, because likely to excite tubercular formation in the mucous membrane of the intestinal canal, or to cause softening and suppuration of tubercle which may have already formed there. The skin is kept warm, by sufficient clothing—flannel not omitted; and clean and perspirable, by daily bathing as well as ablution. The bath should be cold; and sea-water is to be preferred, when season and other circumstances are favourable. Reaction is the object of the bath; and when this fails, either altogether or in part, bathing should be abandoned; perseverance would occasion more harm than benefit, exerting a depressing and relaxing influence instead of one that is tonic. Within doors, the patient should be at all times in an atmosphere which is dry, pure, and often changed by ventilation; and exercise in the open air should be daily practised, short of actual fatigue. If possible, a climate should be made choice of which is dry, bracing, temperate, and free from sudden yet habitual vicissitude. Should the disease threaten, notwithstanding, this regimen is to be assisted by selections from the class of simple tonic medicines—bark, cascarilla, calumba, rhubarb, etc. Alkalis also, cautiously and occasionally administered,* are usually found of service; not only as neutralizing acid to which the patient is especially liable, but also seeming to exert a beneficial influence on the blood.

But there are certain remedies which aspire to the rank almost of specifics in this disease; and the foremost of these are the preparations of iodine, more especially the iodide of potassium. This medicine is given in solution, in doses of from gr. i. to gr. iii. thrice daily; watching the effect, so as to avoid the somewhat violent physiological result which continuance of full doses is apt to induce. The beneficial operation sometimes seems to be increased by combination with cantharides. Iron, likewise, is much in favour; not only as an excellent tonic, but also, like the alkalis, as having a beneficial influence on the blood; probably augmenting the red corpuscles—as well as the proportion of fibrin, indirectly through its general tonic effect. Iodine and iron may be happily combined. The iodide of iron may be given in the solid form, or as a syrup; the latter is usually preferred. The muriates of lime and barytes once held a high reputation, but latterly have fallen into disrepute—except when combined with iron, especially the phosphate. Walnut leaves, in the form of extract, have also been brought prominently for-

* Long continuance of alkalis, it is well known, seldom fails to bring the strongest system into a state of asthenia.

ward ; but their reputation has still to be made. Conium is by many asserted to be most useful, more especially during the progress of ulceration ; exhibited in the form of tincture. Cod-liver oil is invaluable. Benefit may be to some extent due to the proportion of iodine it contains. But besides—in scrofula, it has been said that “the nitrogenized elements of nutrition are in excess ; the evacuations even become albuminous, and are glairy like white of egg ; gradually the albuminous principle of the blood becomes predominant ; at the same time the fatty or carbonized principle disappears, and emaciation takes place ; at length albumen is deposited in the textures, constituting tubercular deposits. The whole of this process is evidently one of perverted nutrition ; and that this is owing to the absence of the carbonized or oleaginous elements, and an excess of the nitrogenized or albuminous, must be evident. The indication of cure then, under such circumstances, must be to introduce into the system the first named principle, namely, fluid fat, or oil, in order that it may combine with the excess of albumen, and constitute a healthy blastema for the support of nutrition.”* By whatever theory its action is explained, there is no denying the fact, that this medicine is of much virtue in scrofulous disease ; alleviating the symptoms, fattening the patient, and improving the general tone of system. To all ages it is suitable, but especially to the young ; given in such doses as the stomach will bear, and generally found to sit most lightly when taken shortly after meals. Sometimes it causes nausea, with loss of appetite ; and then it must be discontinued, at least for a time ; the syrup of the iodide of iron, with cream, glycerine, or some other substitute, being given meanwhile.

The local treatment varies, according to the stage of advancement. While the tubercle is yet recent, and the enlargement external, chronic, and indolent, it is usually our object to effect discussion. The preparations of iodine are used both externally and internally, with this view, as in the case of chronic abscess ; and the form of ointment, applied by friction, is not objectionable here, inasmuch as there is less risk of over-stimulation being thereby induced. Discussion having failed, suppuration is to be sought for rather than dreaded ; and, if possible, it is made to occur within the tuberculated part, in order that full disintegration and removal of the morbid product may ensue.

But, in scrofulous patients, small abscesses not unfrequently form, unconnected with tubercular change. These are amenable to ordinary rules of treatment ; and when they are situated in a part habitually exposed, as the face or neck, a small opening should be very early made, so as to limit suppuration, favour contraction, and avoid the deformity of a large, irregular, and depressed cicatrix.

Usually, suppuration is secondary to the tuberculous formation ; the abscess is of a chronic nature even from the first, and approaches the surface slowly, with a broad front, enlarging almost equally in all directions. If still anxious to avoid an unseemly mark, an early and minute opening may be made ; but the result is likely to be only partially successful. It is better practice to delay evacuation—meanwhile, perhaps, stimulating the part by blisters—until the skin has been thinned, and

* Bennett, on Cod Liver Oil, 1841. See, also, by same author, Remarks on the Treatment of Phthisis.—Monthly Journal, March 1850, p. 236, *et seq.*

until an opportunity has been afforded for disintegration of the tubercle being at all events efficiently commenced, if not perfected. Caustic potass is then used as the opening agent; destroying attenuated skin so far as may seem necessary, and, if need be, at the same time making a destructive thrust into the tuberculated part. The matter is evacuated, and the diseased texture sooner or later comes away; granulation is in due time commenced, and the ordinary means are then adopted to favour its progress and completion. Constitutional treatment is maintained, uninterrupted; and must be long persevered with, after apparent local cure; for, in the general system is the true seat of the disorder.

It is almost unnecessary to state that chronic enlargements of lymphatic glands, by tubercular formation, as in the neck, are not to be made the subject of severe surgical operation. Discussed they may be; or by suppuration they may be broken down and extruded; but extirpation by the knife is in truth an unwarrantable cruelty.

CHAPTER IX.

HEMORRHAGE.

INFLAMMATORY HEMORRHAGE AND EXTRAVASATION.

WHEN the inflammatory process has approached its crisis, we have seen that the vascular coats are apt to give way ; permitting the contained blood—liquor sanguinis and red corpuscles, in mass—to escape more or less copiously. If this occur on a free surface, the accident is termed Hemorrhage ; if the interior of a part, Extravasation. The former most frequently takes place in inflaming mucous membrane, the blood escaping by the mucous outlet ; and is not to be rashly checked, inasmuch as it generally tends towards a beneficial result. The implicated vessels are not only relieved of part—it may be the greater part—of their burden ; but besides, a general resolute effect may be obtained, as if the flow were an artificial one from a vein at the bend of the arm. In such cases, a practitioner, suddenly called, must take care not to suppose that to be of itself a disease, requiring immediate arrest, which is actually a means of cure directed against advancing disease—an occurrence requiring to be watched, perhaps favoured, but only to be arrested when threatening to prove excessive.

When, however, such hemorrhage takes place into an internal space, it cannot be too soon stopped ; and we would rather prevent it altogether, if possible ; seeing that its presence, bulk, and pressure, may excite disease of a still higher grade, or seriously interfere with the function of neighbouring parts. In the chambers of the eye, for instance, extravasation may hurry on the inflammatory process to ultimate disorganisation of the eyeball ; in the pericardium, the heart's action may be fatally overborne ; in the membranes of the brain, coma by compression may ensue.

Extravasation is seldom but injurious, and therefore at all times to be avoided. Occurring in an internal organ, it occasions serious consequences, by arrest or impairment of function not only in that part itself, but also, perhaps, in others adjoining, by pressure made on them. Occurring anywhere, it is unfavourable, as indicating a high grade of the inflammatory process ; one which is breaking up texture, and paving the way for suppuration.

TRAUMATIC HEMORRHAGE

may proceed from wound of an artery, or of a vein, or of both ; or it may be capillary—sometimes, under peculiar circumstances, the most formidable of all. We shall first consider Arterial bleeding.

ARTERIAL HEMORRHAGE.—When an artery is cut across, bleeding is instant and rapid ; the blood of a florid red colour ; and ejected not in a continuous stream, but *per saltum*. The arterial orifice remaining open, and the energy of the heart's impulse being unbroken, much blood is lost in a very short time, from a vessel of any considerable size ; and, *cæteris paribus*, the nearer the wound to the centre of circulation, the more rapid the hemorrhage. In recent wounds, such bleeding is their most prominent and alarming circumstance ; the first to claim attention with a view to its arrest. The means suitable for this end are termed *Hemostatics* ; and are of two kinds ; the work of Nature ; and the work of the surgeon.

Natural Hemostatics.

These, also, are divisible into two classes ; Temporary and Permanent.
I. *The Temporary.* 1. The artery, so soon as severed, *retracts*, in virtue of its elastic nature, within its sheath ; leaving the extreme portion of

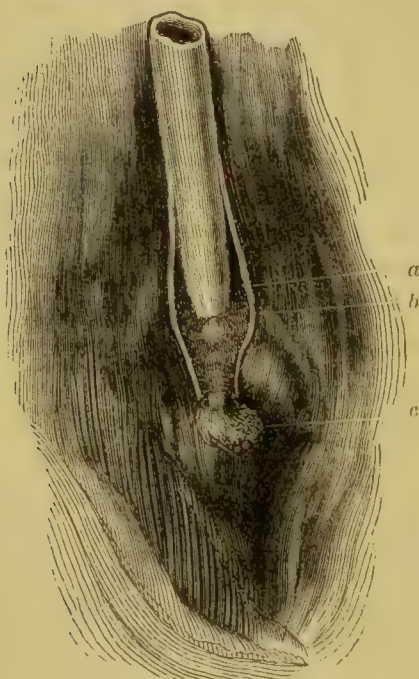


Fig. 83.

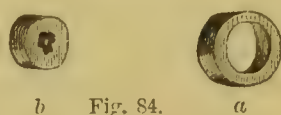


Fig. 84.

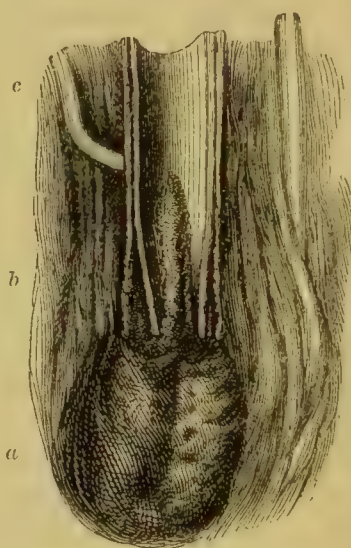


Fig. 85.

that sheath, which does not retract—being without the same elasticity—vacant, and of rough surface. In that vacant space, coagulation occurs. Particles of fibrin become entangled and adherent to the rough points of

Fig. 83. Plan of natural hemostatics, in a cut artery. At *a*, the cut end of the arterial tube ; conical, by contraction. At *b*, the arterial sheath, vacated by the retracted artery, and occupied by coagulated blood. At *c*, the coagulum projecting from the orifice of the sheath.—JONES.

Fig. 84. Contraction of a cut artery shewn ; *a*, the orifice of a dead artery ; *b*, the orifice of a living vessel immediately after section.—SIR C. BELL.

Fig. 85. Plan of natural hemostatics, in a cut artery. At *a*, the external coagulum ; incorporated with the coagulum of the sheath, opposite *b*. There also the internal coagulum seen resting on the external ; and extending upwards as far as the first collateral branch, at *c*.—JONES.

its inner surface ; and these constitute, as it were, nuclei on which others aggregate, to form a clot more or less complete.

2. Also, by virtue of inherent elasticity of tissue, the cut artery, while it retracts within its sheath, *contracts* upon itself, at the cut point ; diminishing its calibre there ; a vital action ; producing a mechanical and obvious obstacle to profuse flow from the orifice—inasmuch as that orifice, at the moment of incision wide, is in a few seconds diminished to perhaps a half of its first dimensions. The more lax and free the surrounding areolar tissue, the more favourably is the vessel situated for contraction and retraction ; and *vice versa*.

3. More direct obstacles are thrown in the way, however ; by *coagulation* of a part of the passing blood. A coagulum forms in the vacant space of the arterial sheath, as already explained ; coming ultimately to occupy that space altogether ; often of a conical shape ; its base resting on the cut arterial coats, its apex projecting in a pouting manner from the orifice of the sheath (Fig. 83, c)—as may be seen in the face of every recent wound. If the wound be open and free, there will be no other external clot ; but, if otherwise circumstanced, a certain amount of sanguineous infiltration takes place into the surrounding areolar tissue ; the blood, so infiltrated, solidifies ; and a coagulum results, more or less extensive—by the pressure of which the arterial orifice is further closed, and the first-formed clot supported in its hemostatic office. The flow having been thus temporarily obstructed, a third coagulum forms ; as after deligation of an artery ; slim and twisted ; its broad base resting on that of the first clot, at the cut arterial orifice ; its slender apex sometimes as high as on a level with the nearest collateral branch.

4. These important changes are aided by the natural consequences of hemorrhage ; mainly two. 1. As healthy blood flows, it becomes more and more *prone to coagulate* ; a state obviously most favourable to formation of the obstructing clots. 2. The patient is affected by a growing *faintness*, and tendency to syncope. The heart's action abating, and the general circulation becoming more and more feeble, contraction of the arterial orifice is favoured, as also the construction of coagula.

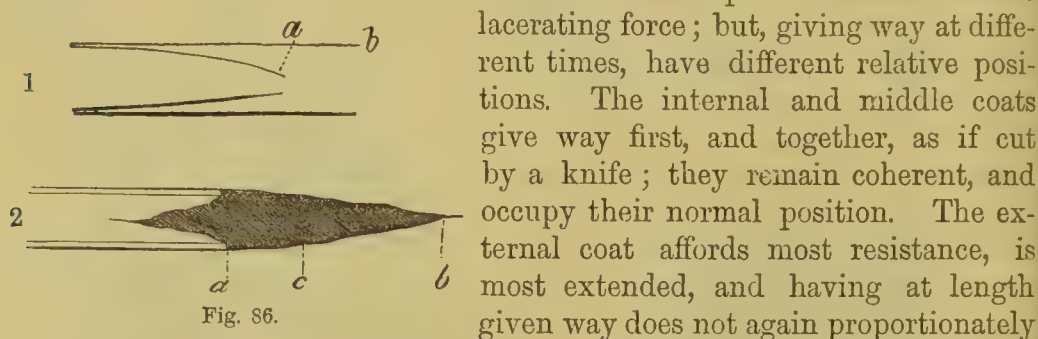
In the distal orifice of the cut artery, similar changes occur as in the cardiac ; and more readily. The contraction and retraction are greater ; and, the blood's impulse being less, coagulation takes place with both greater speed and greater firmness.

By such means, in wounds of the smaller vessels, Nature is herself equal to the task of arresting the flow for a time. And if the coagula be not disturbed by reaction, permanent occlusion of the cut orifice is effected, in the following way : II. *The Permanent*. From the cut arterial coats fibrinous product takes place copiously ; and becomes incorporated with the adjacent portions of coagulum, whose colouring matter disappears by absorption. The new matter becomes fixed and vascularised ; the coats cohere by new and living texture ; and the opening is permanently sealed. At the same time the surrounding tissues are condensed by infiltrated new matter ; whereby the permanent fibrinous arterial closure is, as it were, supported and maintained. The coagula are now useless ; their time and vocation have passed, and, in obedience to the general law, they dwindle down and finally disappear by absorp-

tion. At a more distant date, the like happens to the fibrinous product around; the parts again become loose, and resume their normal texture. The arterial canal has already contracted, up to the nearest collateral branch; forming a narrow cone, the base of which is at the collateral branch, the apex at the arterial extremity. This cone narrows more and more; ultimately the coats cohere, and the canal at that part may become wholly obliterated. Absorption continuing, the consolidated part shrinks to a mere thread.

In the process of natural hemostatics—wonderfully adapted to the end in view—there may be observed a striking similarity to that whereby a broken bone is united. First, the effusion of blood, which coagulates; then the formation of organisable matter; absorption of the coagulum; confirmation of the new product, organised and vascularised—at first redundant in bulk; lastly, absorption of the adventitious structure, and restoration, more or less complete, of the normal state.

In the case of a lacerated artery, natural hemostatics are more readily effected. The arterial coats do not afford an equal resistance to the



lacerating force; but, giving way at different times, have different relative positions. The internal and middle coats give way first, and together, as if cut by a knife; they remain coherent, and occupy their normal position. The external coat affords most resistance, is most extended, and having at length given way does not again proportionately retract. So that the arterial orifice, as represented by the inner coats, is, in the case of laceration, doubly protected; first, by a conical pouch formed by the external coat, stretched to a point before it has given way; and secondly, by the ordinary vacant space of the common sheath, should that remain, as an additional safeguard against bleeding. The existence of the latter, however, is not essential; the coagulation which forms within the stretched and funnel-shaped external coat forming a sufficient barrier against continuance of the arterial flow. In other respects, the process of occlusion is the same.

When an artery is only partially divided, hemostatics are accomplished with greater difficulty. Neither contraction nor retraction can occur. The wound tends to remain open; and, if circulation be active—by reason of the size of the artery, or its propinquity to the heart—there is much risk of a fatal amount of loss, if Nature's efforts be alone trusted to. And yet it is wonderful under what circumstances a successful issue sometimes does occur. Cases are well authenticated, in which the aorta, and even the heart itself, have been punctured; and yet the patients have survived. Syncope having occurred, a coagulum formed in the wound; on occurrence of reaction the clot was not dis-

Fig. 86. 1. Plan of retracted artery, after section; *a*, the conical, contracted, and retracted arterial tube; *b*, the arterial sheath left vacant. 2. Plan of retracted artery, after laceration; *a*, the middle and internal coats of the artery; *b*, the extremity of external coat, forming a pouch, containing, *c*, the coagulum, which extends a short way up the vessel.

turbed ; but, remaining in the gap, it became the means of effecting not only temporary but permanent occlusion.

In the ordinary circumstances of arterial puncture, the hemostatics are as follow :—Blood is infiltrated into the textures exterior to the

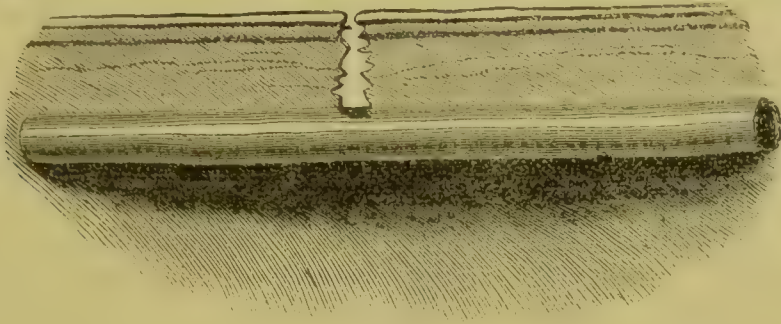


Fig. 87.

sheath, and also between the sheath and the artery ; in both situations coagulation takes place ; and the pressure of the clots obviously tends to moderate the flow through the arterial canal, as well as from the arterial wound. By the infiltration, also, relative position is altered. At the

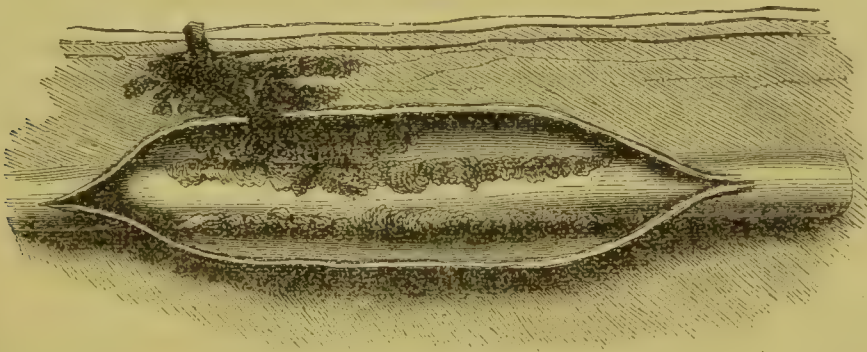


Fig. 88.

moment of infliction, the apertures in the sheath and in the artery corresponded ; but, subsequently, the track of the wound becomes oblique ; and the sheath, where entire, comes to overlap the arterial wound, preventing further escape of blood. It is probable, also, that in many cases the coagulum extends into the arterial gap, nay, may gradually occlude the artery itself. And if the sanguineous flow have been much moderated by pressure from the exterior coagula, as well as by the faintness which loss of blood has induced, the obstructing clot may not be loosened or dislodged ; but may remain, until removed by absorption, after consolidation of the breach by newly organized product.

The formation of this organized product, in and around the gap, constitutes the permanent hemostatics ; as in the case of complete

Fig. 87. A punctured artery. The wound of the integuments uniform and continuous with that in the vessel ; a state favourable to hemorrhage, existing at the time of injury.

Fig. 88. The same vessel, some time after the injury, in altered circumstances. The track of wound oblique, occupied by blood ; and coagula also infiltrated into the surrounding areolar tissue. The arterial sheath slit open, shewing bloody extravasation also there, between the arterial coats and their sheath ; a condition altogether unfavourable to continuance of hemorrhage.

division. It may be such as merely to close the aperture, leaving the normal canal pervious; or it may be to such an extent as to occlude the whole tube, and lead to obliteration at that point. The latter is the more frequent occurrence; and is indeed to be preferred; rendering the occurrence of either secondary hemorrhage, or aneurismal formation, less probable.

The result depends not a little on the form of wound. If a mere puncture, in the axis of the vessel, exist—there is no gaping; hemorrhage is comparatively slight, and the process of occlusion is easily effected; the tube remaining pervious. If the wound be oblique, gaping is considerable, bleeding copious, occlusion more difficult, and obliteration of the canal probable. The more nearly the incision approaches a transverse direction, the greater the gaping, the hemorrhage,

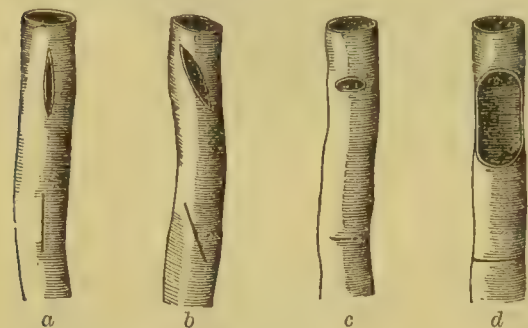


Fig. 89.

the difficulty of occlusion, and the probability of obliteration. When it is not only transverse, but involves more than half of the vessel's girth, the gaping is great; the bleeding is with much difficulty controlled; and ulceration almost always occurs, ultimately severing the undivided portion of the coats. Thereafter permanent hemostatics are then conducted in the same way, and very much under the same circumstances, as if the artery had been at first completely divided.

Surgical Hemostatics.

A most important qualification in the surgeon, called to a case of hemorrhage by wound, is absence of fear or alarm. And this valuable coolness can only be obtained by self-confidence; founded on an intimate knowledge of the means whereby the flow may be arrested, and on a conviction that he is perfectly competent to apply these effectually. His first duty is to expose the wound. Probably it has been covered up with bandages, or napkins, or cloths, by some anxious and unskilful hand, in the vain hope of so stanching the bleeding. These must be all removed. His next duty is to expose the bleeding point. The wound will be found filled with coagulum, through which the blood wells out more or less copiously. This clot must be all dislodged, with the fingers or forceps. Then the cut orifice is seen, sending forth its jet: and then, and then only, can that orifice be dealt with in an effectual manner. Meanwhile, let him compress that bleeding point with his finger, till he determine what the circumstances may require, and what further instruments or assistants he may need to procure. Such direct accurate pressure on the bleeding point will always arrest bleeding from any artery, however large the size. Let him, therefore, set to work

Fig. 89. Plan of wounded arteries; *a*, a mere longitudinal slit, extending to an oval space; *b*, the same wound, in an oblique direction, gaping more; *c*, a less wound transverse, with the proportional gaping great; *d*, a transverse wound of the same size as *a* and *b*, causing a very wide hiatus.—LIXTON.

confidently. A small vessel, with a tiny stream, may be safely left to natural hemostatics ; but when the calibre is at all considerable, and the jet active, there is no safety but in the employment of some surgical means of arrest. These are various. On the whole, none are superior, if equal, to the ligature, skilfully employed ; but some may prove auxiliary to this ; while others may conveniently supersede it in certain circumstances. We shall consider them in detail.

1. *Pressure*.—This may be used, when ligature is either unnecessary or inapplicable. For example, when the bleeding comes, not from one or two arteries of considerable size, but from a great number of small arterial twigs, or when it resembles rather a capillary oozing, ligature need not be applied to each bleeding point ; pressure suffices. Or when hemorrhage proceeds from arterial orifices, imbedded in dense unyielding texture—as in the almost cartilaginous mass of soft parts which invest a necrosed bone, or in the substance of bone itself—dilatation, if attempted, would probably fail ; and here, again, pressure is to be preferred. In limited wounds of the hand and foot, attended with arterial bleeding, and where dilatation of the wound would be requisite to tie the vessel, or again in bleeding from the vessels of the scalp, which are supported by the osseous arch of the calvarium, pressure is generally preferred. It must be early, accurate, and steadily maintained. Early, in order to anticipate infiltration of the areolar tissue ; by which aneurismal formation might be favoured ; or, at least, by which an obstacle, of greater or less bulk, would be interposed between the arterial wound and the compressing agent. Accurate ; because a comparatively slight amount of pressure, applied directly to the bleeding point, suffices to arrest the flow ; while a great amount of pressure, inaccurately applied, may prove ineffectual. And it is a great object to employ no higher degree of pressure than what is barely sufficient ; lest untoward consequences ensue. The limb might be so tightly girded as to threaten gangrene ; at all events, severe pressure, long maintained, is certain to induce suppuration and ulceration of the wound, which may determine secondary hemorrhage at a later period.

Due pressure is applied in the following manner :—The wound, and the bleeding point in the wound, having been exposed, as already directed, and the finger or thumb placed accurately on the latter, so as temporarily to arrest the escape of blood, an assistant carefully bandages the whole limb from below upwards,

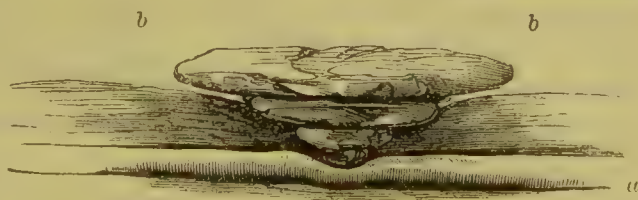


Fig. 90.

so as to afford an uniform degree of support to the whole, and prevent untoward consequences from the concentrated pressure which is about to be applied to the wound (Fig. 36), p. 136. As the finger or thumb is cautiously removed, a small, firm, dossil of lint, not larger than the finger's

Fig. 90. Plan of a graduated compress. *a*, The artery wounded ; *b, b*, the graduated compress arranged, so that the apex of the cone is in immediate contact with the arterial orifice, while its mass occupies the general wound, and projects somewhat above the integumental level.

end—supplies its place ; laid in immediate contact with the arterial orifice. Over this, another and another—each increased in size—are rapidly applied, till the wound has become filled with a graduated compress ; of a conical form ; its apex in contact with the arterial wound, the base projecting a little beyond the level of the surrounding integument ; the whole fitting and filling the wound in every part. This accurately fitted compressing agent is then retained in its place, by continuation of the bandage upwards ; and the degree of pressure is regulated, by the tightness with which the roller is drawn. The whole surface of the wound is compressed somewhat ; but the main pressure is concentrated directly on the bleeding point.

If the dressing remain dry and unstained by blood from beneath, it is a sign that the application is effectual ; and it is left undisturbed. If, on the contrary, blood soon appear, and trickle through, the whole must instantly be undone, and re-applied more carefully. Blood, having oozed through the dressing, must have previously collected in the wound ; coagulation has taken place there ; and the interposition of a clot, between the compress and the bleeding point, renders pressure inaccurate, and consequently ineffectual.

The dressing, when satisfactory in its immediate result, is retained for three or four days ; unmoved and unabated. Then the apparatus is undone, and re-applied more lightly than before ; and, having been retained for several days more, it may then be wholly discontinued. In re-application, it is well not to interfere with the deep part of the compress ; if dry, accurately applied, and adherent. And, after pressure has been wholly removed, the deep part of the compress should not be taken out by forceps or fingers ; but should be permitted to come away, loosened by the discharge. The less the advancing occlusion by plastic change is disturbed, the better. The pressure may be likened to Nature's temporary hemostatics ; restraining the flow, temporarily, by the intervention of mechanical obstacles ; till time and opportunity are afforded, sufficient for permanent occlusion by organized new material.

In the case of slight wound of a large vessel, pressure may be so regulated as to effect occlusion of the arterial *wound* only ; leaving the arterial *tube* pervious as before. But, as formerly stated, this is not only an unnecessary but a dangerous refinement in surgery ; not unlikely to favour aneurismal formation. It is easier, safer, and altogether more advisable—should it be thought prudent to trust to pressure at all—to apply it so forcibly as to obliterate the arterial canal at that point ; not only temporarily but for ever.

Pressure may be applied indirectly and temporarily ; with the view of restraining hemorrhage, until the necessary means have been adopted for securing the bleeding points. Thus, in copious hemorrhage from a wound of the leg, it is advisable to compress the femoral, until direct hemostatics have been completed. For this purpose, the fingers or thumb of an assistant can be employed ; and these are the best compressing agents, when steady and exact. Or a mechanical substitute, acting in a similar way, may be used ; consisting of a strong steel spring, furnished with a pad at either extremity ; one of which pads is applied accurately over the arterial trunk, the other resting on the opposite part

of the limb. Or Signoroni's compressor may be employed. By either of these methods, pressure is confined to two points ; and the evil consequences of uniform constriction of the whole limb are avoided. The mechanical contrivance is inferior to the living fingers in one particular ; it is more apt to slip, and thus to endanger considerable loss of blood ere re-adjustment can be effected. But it has one equally obvious advantage. However tedious the manipulations of the wound may prove, requiring long continuance of temporary pressure above, it is not liable to become unsteady or wavering from cramp or fatigue.

The most common expedient for indirectly and temporarily restraining hemorrhage, is the *Tourniquet*; a circular band, whereby the whole circumference of the limb is constricted; tightened by a screw, which at the same time forces down a compress or pad upon the vessel's track with a special inten-

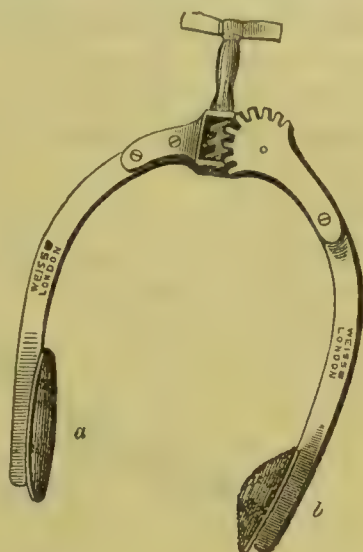


Fig. 91.

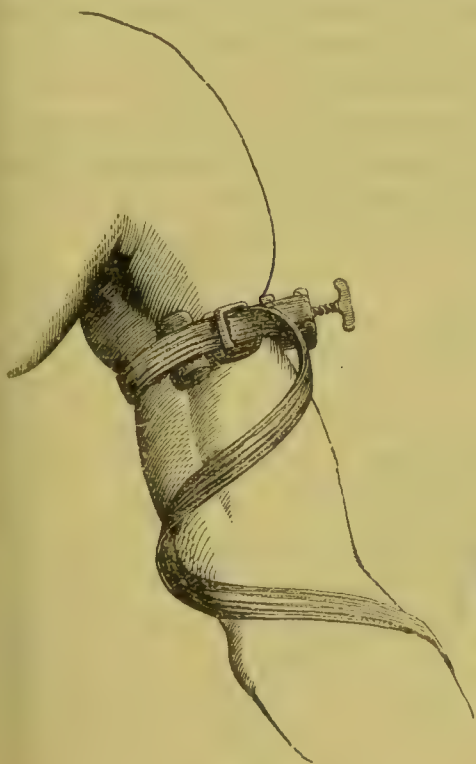


Fig. 92.

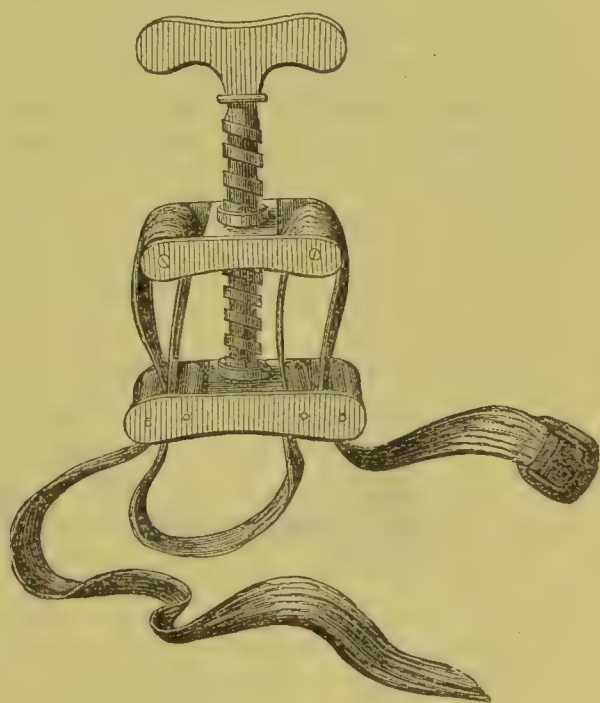


Fig. 93.

sity of compressing force. The objections to this instrument are:—the pain which tight constriction of the limb cannot fail to produce,

Fig. 91. Signoroni's compressor. *a*, The point of counterpressure; *b*, the pad which acts directly on the vessel.

Fig. 92. The ordinary tourniquet shewn in application to the brachial artery. A bandage enacting the part of compress over the vessel.

Fig. 93. The tourniquet, unapplied; but with its two platforms as much separated, as if in actual use.

and the favouring of venous hemorrhage which must necessarily result from so complete an obstruction of venous return. Its advantages are, that when applied, it is not likely to become displaced; and, with it, we are so far independent of an assistant.

A very convenient form of the instrument is that invented by Dr. Malan; the screw flat, and double, admitting of the principal pressure being more rapidly and powerfully applied; and when adjusted, less in the way of the operator, and consequently less apt to be displaced by the accidental application of lateral force.

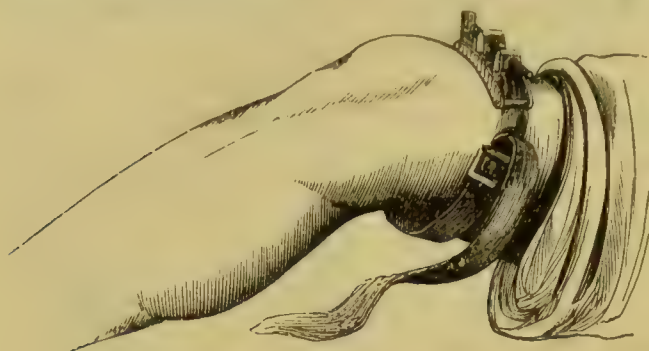


Fig. 94.

Mr. Skey has contrived an efficient tourniquet, with the view of

avoiding the evils of uniform circular compression. "It is composed of two semicircles, one of which fits into the other by running in a groove. Each half is fixed by a spring catch to the other, and may be enlarged or reduced at will. In the centre of each semicircle is the pad for pressure and counter-pressure, the former being provided with the ordinary screw."

Whatever tourniquet is employed, care must be taken lest by excessive continuance of its use the limb be strangled, and gangrene endangered, or undue loss of blood be caused by arterial influx being to some

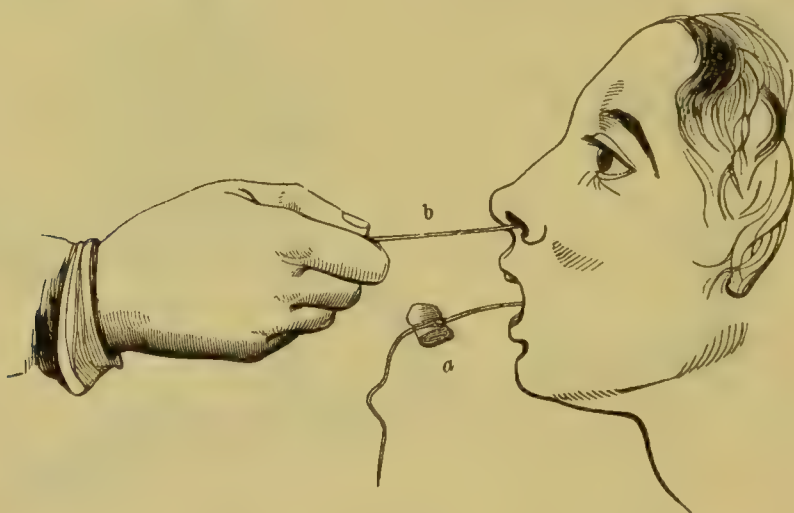


Fig. 95.

degree permitted, while venous return is stopped. This applies specially to those instruments which involve general constriction of the limb.

2. When hemorrhage has occurred into an internal cavity or canal,

Fig. 94. Malan's flat tourniquet, applied to the popliteal.

Fig. 95. Example of arresting hemorrhage by plugging. A plug, *a*, about to be lodged firmly in the posterior nares, by means of the ligature, *b*. This having been done, and a plug afterwards placed in the front nares, the bleeding from *that* nostril is fairly commanded.

whose parietes are not very extensile, compression may be less exact than in an external wound, yet efficient. In profuse bleeding from the uterus, for example, we obstruct the vagina; in epistaxis, we plug the nares.

In amputation, or operations on bones, profuse and troublesome bleeding may take place from a large vessel imbedded in an osseous canal, and may refuse to be arrested by ordinary means. Pressure has been tried; ligature is inapplicable; the actual cautery is also inexpedient. Under such circumstances, if temporary direct pressure do not suffice, it is well to fit a piece of wood or cork into the aperture; securing it there, by the requisite degree of force. A portion of ligature is attached to the plug, and left pendent from the wound; and by this it is removed, so soon as the period of its usefulness has passed, and when it has become spontaneously loosened by the suppuration which its presence necessarily excites.

3. *Position* is important; so regulated as to retard and oppose arterial supply of the wounded part. The sanguineous flow being thus moderated, natural hemostatics are plainly favoured. In wound of the hand or foot, for example, the injured part should be placed in as elevated a position as circumstances will permit, and so retained till hemorrhage has ceased.

4. *Cold*.—Cold is useful, not by superseding Nature's temporary hemostatics so much as pressure does, but rather by assisting them. It is applicable to the slighter cases; to oozing, rather than to ejection of blood. Opening up of the wound, and exposure to atmospheric air, may often suffice. Or, this failing, a greater degree of cold is applied by means of lint, moistened in water; taking care that the cold is continuously maintained, either by the system of constant irrigation, or by very frequent wetting of the lint. This mode of treatment is in two ways useful; first, by tending to arrest hemorrhage; second, by tending to avert inflammatory progress, and so to favour adhesion. The former indication is fulfilled by the cold repelling general circulation from that part of the surface to which it is applied, at the same time constringing the vessels; also, by increasing contraction of the cut arterial orifices, and favouring the formation of coagula.

5. *Styptics*.—These also are auxiliary to the natural hemostatics. Cold water may be ranked among the number; the simplest, and the most generally applicable. There are others, however, which have a more powerful constringent effect on the arterial tissue; as gallic acid, turpentine, creasote, matico, solutions of iron, alum, zinc, mercury, etc. Of these, a strong infusion of matico deservedly stands high in favour; and a saturated solution of the perchloride of iron is still more energetic—with this qualification, however, that it may prove somewhat escharotic to the tissues to which it is applied.

Whatever be their action, styptics may be generally rated as applicable only to the slighter forms of hemorrhage; more especially to cutaneous or mucous oozing; and even then, not advisable until the more ordinary and suitable means—cold, exposure to atmospheric influence, and attention to position—have been tried, ineffectually. For styptics, being usually more or less of a stimulant nature, are in their ultimate effects

unfavourable to the healing process ; inducing suppuration, or even sloughing to some extent ; and so preventing adhesion.

Some substances, as agaric, cobwebs, felt of a hat, etc., adhere to the surface ; at the same time entangling the blood and favouring the formation of coagulum ; and thus they mechanically tend to arrest bleeding.

Certain of the styptics, when taken internally, assist in restraining hemorrhage. Gallic acid, matico, and turpentine, are especial examples of this class.

6. *Escharotics*.—These may be actual or potential. Of the latter class, the saturated solution of the *perchloride of iron* and the solid *nitrate of silver* are often employed. They have an astringent effect on the arterial tissue, like the more simple styptics ; and, besides, tend to induce immediate coagulation of the sanguineous and other fluids with which they come in contact, on the surface to which they are applied. This coagulum, further, is adherent to the texture beneath ; and thus these remedies combine the two modes of action which the class of styptics was said to possess ; constringing the vascular orifices, and at the same time covering them with an adherent mechanical obstruction. They form good applications in the minor cases of obstinate bleeding ; especially in mucous and cutaneous surfaces. Often they may be trusted to alone in such cases. In others, of a more serious nature, they may prove an excellent auxiliary to pressure. There are some cases of bleeding, partly arterial, partly by oozing, in which it is impossible otherwise to have the compress placed—dry and firm—in immediate contact with the bleeding points ; and, as stated previously, an inaccurate compress is likely to prove ineffectual. In such a case, nitrate of silver—or, better, the perchloride of iron—is first applied to the part ; not so much to cause a truly escharotic effect—killing a portion of texture, which must afterwards be detached ; but simply so as to produce the hemostatic result formerly described. The bleeding is stanchd for a time ; it may be but for a moment. But even that short space of time is of much value ; enabling us to apply the dossil directly and accurately to the part ; without interposition of blood, either fluid or coagulated. The coagulum, made by the nitrate of silver, is but a thin film ; not inconsistent with accuracy of pressure.

The actual cautery is a more severe remedy, to be reserved for more urgent cases ; those examples of serious bleeding, for whose arrest other means are deemed inapplicable, or in which other means have been already tried and have failed. As it sears the surface, the vascular orifices become shrunk, shrivelled, and charred ; and this effect itself is powerfully hemostatic ; the shrivelling being such as to obstruct the canal. But, besides, all the textures of the burnt part are converted into a dead eschar, in thickness and extent proportioned to the intensity of the application. To constitute this eschar, the previously living and open texture is not only killed, but also condensed and contracted ; and this change is to such an extent as to render the mass impervious to blood. This mass adheres to the living textures, around and beneath, until detached by the ordinary process of ulceration. So long as adherent, it mechanically restrains the flow of blood ; and when loosened, it is probable that the ordinary concomitant and antecedent plastic change has sealed the vascular orifices, and permanently arrested hemorrhage. The

formation and adhesion of the eschar may be likened to Nature's temporary hemostatics ; the plastic formation which precedes, accompanies, and follows detachment, to the permanent. If such formation be wanting or imperfect, the styptic effect of the cautery will be but temporary. Sometimes such is the case ; and therefore, at all times, the period of the eschar's separation must be one of anxiety and care. And at this time it is well to take additional means for security ; by the application of moderate pressure.

7. *Ligature*.—This is sure and satisfactory ; and not to be superseded or omitted, for light

reasons, in any case of considerable hemorrhage from arterial wound. The effects of a firm round ligature, duly applied, will

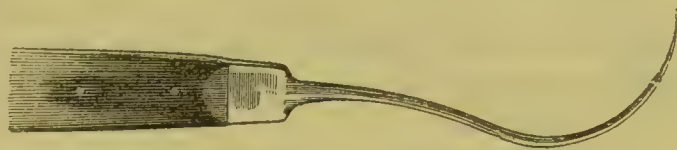


Fig. 96.

be spoken of in connection with deligation of arteries for the cure of aneurism ; at present we consider only the mode of use. The arterial orifice is first laid hold of, and pulled outwards from the surrounding



Fig. 97.

textures ; in order that the ligature's noose may embrace it, and it alone. For this purpose, a sharp hook, termed a *tenaculum*, may be employed ;



Fig. 98.

but forceps are more convenient, and usually preferred. They may be such as are used ordinarily in dissection ; not too sharp in their points,

Fig. 96. Tenaculum ; or sharp hook, whereby the arterial orifice is picked out.

Fig. 97. The spring artery forceps ; ordinarily employed in preference to all other means, for taking up the arterial orifice.

Fig. 98. The forceps shewn at work ; after amputation below the knee. The artery fairly isolated, and made to project. Seldom it protrudes so far ; but when it does, the ligature is applied close to the base, and scissors or knife amputates the redundant part.

and with their prehensile surfaces accurately adjusted to each other. Or the spring artery forceps, with accurately fitting toothed points, may be used ; and in most cases they are preferable. First, because maintaining a secure hold of the vessel—even when left to themselves, independently of the hand of the surgeon ; and so, in the case of scarcity of assistance, admitting of the bleeding orifices being more rapidly silenced. Secondly, because it is difficult for the assistant who secures the noose, to include the extremity of the instrument along with that of the vessel—a casualty not unlikely to occur with the ordinary forceps, among inexperienced fingers, or even with much expertness in a deep and narrow wound. Especial care is taken that nothing but arterial tissue is included in the noose ; and, to this end, the surrounding textures are pushed back by the finger nail, if need be.

By the interposition of other tissues than the arterial, at least three dangers are encountered. 1. The inner coat is not divided ; does not resile from the bight of the ligature, and so become favourably situated for adhesion of the external coat taking place ; but remains in the embrace, and must slough, inflame, and ulcerate. 2. Nerve or vein, being usually in close apposition to the artery, is likely to be included ; and deligation of either is likely to induce results both painful and dangerous. 3. There is a larger extent of slough rendered unavoidable. For its separation, a proportionally great amount of ulceration must ensue ; and thus the danger of secondary hemorrhage is increased.

On the other hand, if the vessel, by laxity of the surrounding parts, be much protruded in an isolated state, the noose should be applied near the base of such projection ; otherwise the vital power necessary for subsequent occlusion might prove deficient. In obedience to this sound maxim, it may happen that after application of the ligature a considerable portion of bare artery is left dangling in the wound. It is well to shorten this, by knife or scissors ; for obvious reasons. But in ordinary wounds this is seldom required.

The first noose is drawn tightly ; not with force sufficient to endanger a tearing through of all the tunics ; but so as to insure the giving way of the internal and middle coats—a circumstance so essential to adhesion, and consequent permanent occlusion. The second noose is also firmly applied ; and so as to constitute the reef-knot ; one which will neither slip, nor be pushed off by the arterial impulse.

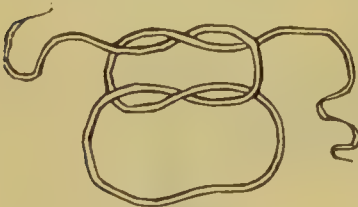


Fig. 99.

In this manner, each vessel is tied ; rapidly, so as to prevent unnecessary loss of blood ; yet not hastily, so as to endanger carelessness and inefficiency of deligation. Every vessel which is plainly arterial and plainly bleeding, should be secured. In an extensive wound, there are muscular branches which seem small and unimportant, after we have just completed the treatment of the larger trunks ; the patient is probably by this time faint ; and the bleeding from these points may be little more than mere oozing. Still, experience inculcates the expediency of deligation being extended to most of these. Otherwise, so soon as reaction has

Fig. 99. The surgeon's knot roughly shewn ; not yet tightened.

been fairly established, natural hemostatics are overborne, and copious reactionary hemorrhage, or "after bleeding," ensues. What were before mere oozings, are now distinct and active streams, each demanding ligature; and rendering a painful undoing of the wound, for this purpose, absolutely indispensable. To avoid this, such vessels should be tied at the same time, and in the same way, as the larger trunks. Better apply one or two ligatures, even unnecessarily, than encounter the risk of reactionary bleeding—perhaps seriously injurious; and of fresh deligation—always troublesome and painful. In reference to this subject, it is well to remember that it is not an ordinary reaction with which we have to do; but one whereby the wonted contents of the obstructed main vessels are thrown upon small collateral branches, which, in consequence, are unusually excited to hemorrhage.

When an artery has been cut obliquely, as is likely to happen in amputation by flaps, especial care must be taken that the orifice is well pulled out from the surrounding textures, previously to deligation; otherwise, the noose may be thrown *upon* the oblique arterial wound, instead of *behind* it; and the artery, thus left partially open, cannot fail to bleed.

If an artery be not cut across but merely punctured, or a piece cut out of it, two ligatures are essential; one above, the other below the opening. One ligature, on the cardiac aspect, may arrest bleeding for a time; but, so soon as collateral circulation has become fully established, the distal orifice will bleed almost as profusely as did the other. There is no safety but in two ligatures. And the same rule holds good in regard to an artery, when cut across, whose distal orifice remains imbedded in living texture. For example, in amputation of the thigh, the femoral artery requires but one ligature; but if a mere wound be made in the thigh, implicating that vessel, both distal and cardiac orifices must be secured; free dilatation of the wound, if necessary for this end, being unhesitatingly performed.

Sometimes an arterial orifice is surrounded by textures so dense, as to render the ordinary use of ligature impracticable. In such a case, if pressure fail, or seem unsuitable, we may be compelled to apply the ligature somewhat clumsily; in order to avoid the greater evil of unnecessary loss of blood. A curved suture-needle is passed through the bleeding point; so as to transfix it, and yet include as little as possible of the surrounding parts; and, around the needle's convexity, the ligature is secured—very tightly. The needle is then either withdrawn, or permitted to remain for a time; according as circumstances may seem to indicate. Or the needle may be carried through the textures so as to surround the bleeding point in the loop of the ligature which follows; and on tying this, the vessel and the textures with which it is surrounded are so constricted as to prevent further bleeding.

When the bleeding points have been all secured, the ligatures then come to be arranged, with a view to dressing the wound. If this be left open to suppurate, and heal by granulation, both ends of each ligature are cut away close to the knot; the knot loosens in due time, and passes away with the discharge. If, however, we intend to bring the wound together, and treat it for adhesion, one half only of the ligature

should be cut away, the other being left pendent from the wound ; in order that separation and discharge of the noose, with its enclosed slough, may be watched and made certain.

By some, both ends are cut away ; in the belief that adhesion is thus favoured, throughout the line of wound—as doubtless it is ; and in the hope that the noose will become encysted, and give no further annoyance—as certainly it will not. Adhesion under such circumstances is somewhat of a misfortune. For the noose and its contained slough are to all intents and purposes foreign matter ; as such, their presence will be resented by the surrounding living textures ; and, as such, they will be extruded by suppuration. Sooner or later—often after cure has apparently been completed—deep abscess forms ; painfully and slowly having approached the surface, pus is discharged—and with it, its cause, the noose. Not until this latter has been put forth, will the pain and discharge cease. Or, before this, the arterial coats may have been too far encroached on by the pent-up collection ; they have become ulcerated, perhaps at a part where the canal is yet free ; and secondary bleeding ensues.

8. *Torsion*.—This is an imitation of the means whereby the lower animals, in parturition, by gnawing and twisting the umbilical cord, instinctively arrest its hemorrhage ; and an adaptation of the general fact, that torn arteries, more readily and effectually than the cut, undergo



b Fig. 100.

natural hemostatics. The arterial orifice is pulled outwards, by forceps, to the extent of half an inch or so. The base of this isolated part is then seized transversely by other forceps, which hold it securely ; and by which at the point grasped the internal and middle coats are divided. While this instrument is steadily held, the extremity of the vessel is, by means of the evellent forceps, twisted several times upon itself. It is then left pendent in the wound.

This method is only applicable to arteries of the middle class. The small vessels cannot be so treated easily ; the large cannot be so treated with safety. In every wound, therefore, wherein the three classes of vessels are implicated, some ligatures must at all events be applied ; and it is not easy to see what disadvantage can accrue from deligation being extended to all. Application of a ligature can be effected in fully as short a time as torsion ; and when applied, the ligature is undoubtedly a more certain hemostatic. The twisted portion of the vessel must slough and separate ; the noose of a ligature is not more truly, or to a greater extent, a foreign body. Torsion, therefore, is never superior to ligature ; and it is doubtful whether, under any circumstances, it may be consi-

Fig. 100. Torsion forceps ; *a*, the points accurately and sharply serrated, so as to bite deeply into the arterial coats ; *b*, the slide which, when shut, secures the vessel in the embrace of the instrument.

dered equivalent. Its use is expedient only in the case of a second-class artery, when, from scarcity of assistants, want of apparatus, or other accidental circumstances, deligation is inconvenient. In this country, it is seldom employed; unless, indeed, this be called Torsion—namely, when, seeing a small arterial orifice which scarcely demands ligature, we seize it with the ordinary forceps, give it two or three turns, and then expect to find it silent.

9. *Needles: Acu-pressure.*—Professor Simpson has recently revived and extended the use of this hemostatic agent. The needle is either inserted into the textures from the cutaneous surface inward, till its point comes out upon the surface of the wound close by the bleeding vessel, when the point is carried over the arterial tube and then pushed onwards among the tissues, whose elasticity compresses the needle against the artery. Or a common sewing needle, with wire threaded through the eye, is passed into the textures upon the surface of the wound, in like manner effecting the compression. In either method the needle is withdrawn at the end of one, two, or three days. The advantages, alleged and apparent, are—facility of application in some cases, little injury done to the arterial and other tissues, the avoidance of arterial slough, the temporary lodgement of the foreign body, and the comparatively innocuous character of the foreign body which is lodged—circumstances plainly favourable (theoretically) to primary union. The balance *per contra* mainly consists in the difficulty of application in many cases where ligature is readily available, and a sense or suspicion of inadequacy as a hemostatic power. Should experience prove that acu-pressure is quite trustworthy to stop bleeding permanently, and that its use is really followed by a more frequent occurrence of primary union in the wound—a case were made out manifestly in its favour. At present, however, the profession seems inclined to believe that its hemostatic certainty, as well as its general applicability, is inferior to that of the ligature, and that primary union happens just as often in the one way as in the other; its occurrence being due not only to local, but very materially to constitutional and hygienic conditions—unconnected with the wound.

10. *Nauseants and General Treatment.*—One of Nature's hemostatics we found to consist in faintness, supervening on loss of blood. This may be imitated by art; ere yet so much blood has flowed as to establish the natural result. The means are valuable in cases of internal hemorrhage, as from mucous surfaces; to which pressure, ligature, and the other more direct hemostatics are inapplicable.

The patient is made sick and faint; so that blood may circulate more slowly and gently in the wounded part; favouring coagulation. Actual syncope is not wished; for reaction is likely to follow, and by it bleeding may be reinduced. Neither is actual emesis sought; for that includes violent muscular exertion; and is also likely to be followed by reaction; both circumstances favourable to bleeding. Derivative bleeding from the arm has been practised for this purpose; but nearly the same end may be obtained by the exhibition of such simple nauseants as ipecacuanha or antimony—or simple sedatives, as aconite, or veratrum viride—while yet the important fluid is spared within the

veins. Rest—including repose of both body and mind—low diet, cool drinks, ices, and the general regimen suitable for moderation of the circulation, will not be neglected.

In urgent hemorrhage, opium is of great importance; given in moderate doses, frequently repeated; on an average, half a grain or a quarter of a grain, every half hour—but the interval necessarily varying according to the effect produced. Its main action seems to be by imparting to the system a power of bearing up under the loss of blood; and at the same time it may assist in obtaining hemostatic results. Some suppose that the preservative action is by inducing congestion in the brain—“That amount of congestion by which opium occasions apoplexy, when given to persons in health, seems only sufficient to sustain the natural and necessary tension of the cerebral vessels in those who are dying of hemorrhage.”*

Syncope.—This, when temporary, is Nature’s last resource in cases of urgency. By its occurrence, arresting all flow for the time, lives are often saved; opportunity being so afforded for use of the required surgical means.

Unless bleeding has been satisfactorily stopped, by treatment of the wound, the condition of faintness is not to be disturbed. When, however, all has been duly overtaken, and syncope still continues; we naturally become anxious that the patient should emerge from that state. The means are simple. The cause of syncope is twofold; deficient supply of arterial blood in the nervous centres, suspending their functions; inadequate stimulus to the heart, retarding its play. Both are to be counteracted. The patient is placed recumbent, and all means taken to leave respiration unimpeded—as by slackening or removing tight articles of dress from the chest. The head is placed rather lower than the rest of the body, so as to favour the flow of blood to it. It is a very mistaken kindness to prop the head with pillows, and otherwise endeavour to give the appearance of comfort. The heart still acting feebly, and much blood having been lost, it may be advisable, in serious cases, to compress the abdominal aorta and axillary arteries, so as to husband what of the vital fluid remains, and keep it circulating where it is most required; in the chest and head. By dashing cold water on the face, applying stimuli to the nostrils, rubbing and compressing the chest, respiration is favoured; and by the full establishment of this, the heart will be forced, as it were, into renewed play. In desperate cases, galvanism may be employed to restore function in both heart and lungs.

Transfusion.—This is the last resort of all. Warrantable, nay demanded, when circumstances are favourable for its practice; and when there is good prospect of the patient’s ultimate survival, were the immediate risk by loss of blood removed.

There is no time to recruit the circulating system, by chylous elaboration on the part of the patient. The blood required, to atone for the existing deficiency, must be immediately supplied; and can be obtained only from some fellow-being who is generous enough to afford it. For obvious reasons, a robust healthy person is preferred.

* Brit. and For. Rev. 41, p. 107.

A syringe, with suitable tubes and nozzles, is made on purpose for this operation. Seen to be scrupulously clean and well adjusted, it is brought into the same temperature with the body. A vein in the arm of the patient is laid bare, and an incision made of sufficient size to admit the tubule through which injection is to be made. Blood is then drawn in the ordinary way from the emittent patient ; and as it flows into a basin, it is steadily injected into the recipient ; care being taken that no air or coagulum is permitted to enter. And to avoid the former accident, the tubule is not inserted into the vein, till the syringe has expelled its air, and blood is flowing freely. Or, the syringe being provided with two tubes and nozzles—an afferent and efferent, a direct communication is made between the emitting and receiving veins. The effects are watched ; and the amount of injection is regulated accordingly. On an average, from half a pint to a pint will suffice to restore life and circulation. Rapid or excessive injection would be liable to overburden the heart, and produce serious consequences. When no apparatus is at hand, a softened bladder, with a medium-sized trochar and canula, may be made very satisfactorily to effect transfusion. The bladder should have the trochar and canula passed through its fundus. The bladder is then secured with thread around the canula, the trochar withdrawn, and the canula passed into the vein in the recipient's arm. The mouth of the bladder is then held wide open to receive the stream of blood from the emittent patient, and the transfusion is effected by gravitation ; thus avoiding all risk of air entering the vein.

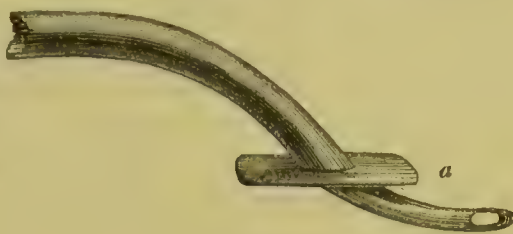


Fig. 101.

Accidents by phlebitis, in either patient, are not unlikely to occur ; and must be duly provided against. On this account, the operation is not expedient except in otherwise desperate circumstances.

Secondary Hemorrhage after Arterial Wound.

In all cases of serious wound, whereby important arteries have been implicated, there is risk of secondary hemorrhage. And this may occur at various times, and from different causes.

1. It may happen within a few hours after the first dressing ; so soon as the patient has become hot and comfortable in bed, and reaction has been fully established. This, for distinction's sake, may be called "after bleeding," or "reactionary hemorrhage." A ligature, clumsily applied, may have been pushed off. More probably, some of the oozing vessels, formerly described, have been overlooked, and unwisely spared from deligation ; their natural hemostatics have given way, and they are now bleeding more or less copiously. The wound must be undone, the bleeding surface fully exposed, and each vessel now carefully secured.

2. Or sloughing may attack the wound, and unoccluded vessels thus be opened into. If the slough be but partial, and the opened artery not

Fig. 101. Nozzle for insertion into the vein, in transfusion. *a*, The shield which, compressing the integument, prevents outward escape of the blood.

large, pressure will probably suffice. If not, then the vessel may be exposed, by direct incision, at the bleeding point ; and a ligature placed above and below the aperture. Should the attempt to secure the distal portion of the vessel fail, the cardiac ligature, with exact and moderate pressure on the wound, may be alone trusted to ; and in all probability it will prove successful. If the sloughing be general and the vessel large—and if from any cause it cannot be tied at the bleeding point—then the main artery leading to the seat of hemorrhage may be secured, by incision on the cardiac aspect, as the only means in our power of controlling the bleeding.

3. Or an artery which has been secured by pressure and natural hemostatics, at the time of injury, bleeds within a few days ; and there is neither ulceration nor sloughing in the wound. This is found filled with coagulum ; and is lined with a fibrinous inflammatory product. In such circumstances, the wound is dilated by direct incision ; and, the bleeding point having been exposed, the vessel is secured by ligature ; this being double—above and below the bleeding point—in all cases where the artery may bleed again from the distal side. Sometimes detection of the vessel is facilitated, in a deep wound, by the circumstance of its orifice being surrounded by a greenish-yellow discoloration.

4. Or a vessel, which at the time of injury was tied, bleeds in consequence of ulceration of an asthenic kind, at the time of the ligature's separation ; as after deligation on account of aneurism. In this case, some considerable time usually has elapsed ; eight, ten, or twenty days. The parts implicated have become infiltrated, and are changed both in structure and in relative position. Besides they may be the seat of asthenic ulceration ; and, for the time, incapable of healthy efforts of repair. In such circumstances, detection and isolation of the bleeding orifice will be difficult ; but when found, although the prospect of obliterative changes by deligation may not be promising (theoretically), experience has proved that the vessel may bear the ligature, and that a repetition of the hemorrhage when it separates is by no means inevitable. Notwithstanding, instead of a direct ligature, it is still very generally considered better to tie the main artery, at some distance, on the cardiac side ; maintaining exact, continuous, and moderate pressure on the original wound. In resorting to this plan of treatment, however, the surgeon should make sure that the bleeding really comes from the vessel on the cardiac aspect of the ligature ; for in many cases it has been found that the bleeding is due to regurgitant hemorrhage from the distal portion of the vessel. In any case, the general means suitable for the restraint of secondary hemorrhage are not to be neglected.

Of late, there has been a good deal of discussion as to the proper treatment of secondary hemorrhage after arterial wound. But the sound practical conclusion seems to be this. It is always desirable to tie the vessel above and below the bleeding point, by direct incision ; and that should always be done when practicable. But when, from any cause, direct deligation has been rendered impracticable, inexpedient, or both, then cardiac deligation may be resorted to, as in the case of aneurism—the point of deligation being always, if the bleeding comes from the proximal end, as near as possible to the site of bleeding—with pressure

on the original wound, or not, as circumstances may seem to indicate—and on the cardiac side of the branches which anastomose with the main trunk, beyond the site of hemorrhage, when the bleeding comes from the distal extremity of the deligated vessel.

Venous Hemorrhage.

Venous blood, as contrasted with arterial, flows in a dull and dark stream; but, by continuance, not less capable of perilling life through syncope. Pressure is the general and preferable means for its arrest; along with removal of all obstruction to venous return. In amputation, for example, it sometimes happens, that after the arterial jets have been secured, dark streams continue to issue somewhat profusely from the venous orifices. Our first care is, to see that all pressure from above has been removed; whether by tourniquet, or by the fingers of an assistant. Such removal often suffices, of itself, to stanch the flow. If not, let pressure be employed; either directly on the venous orifices, or by approximation and compression of the lips of the wound. After a few minutes, let the pressure be gently removed; and then, usually, bleeding will be found to have ceased. If not, let a compress of lint be applied to the bleeding point or points; graduated, secured, and maintained, as if for an artery similarly circumstanced; only with less intensity of pressure; a comparatively slight amount of this, if direct and accurate, being sufficient to restrain the flow. By this means, the venous coats are held in undisturbed contact; plastic formation takes place from them, and from the surrounding parts; and by it—becoming thoroughly organized—the venous canal is effectually and permanently closed.

By every means in our power, we ought to avoid deligation of a vein. For, as will afterwards be seen, a form of phlebitis ensues, which, especially in its higher grade, is apt to spread; and, therefore, it need be no matter of surprise to find the very worst results of that disease, supervening on the application of ligature to a vein. Such risks are undoubtedly greatest when the ligature is applied to a wounded or divided vein in the continuity of a limb, and when the venous circulation continues by other channels to flow past the site of deligation. The risks are least when the deligation is practised on a stump after amputation; and when the coagulum which results extends but a short distance from the point of ligature. Some pathologists, no doubt, look upon accidents from this cause as little else than fanciful; and some practitioners have no scruple in tying veins as readily as they do arteries, not anticipating damage or danger thereby; notwithstanding, we think it well to err (if we do err) on the safe side, by avoiding such source of injury—all the more as venous hemorrhage can always and certainly be restrained without ligaturing the coats of the vein.

It may happen that no accident ensues; that the ligature ulcerates its way out; that plastic formation extends around; that the vein is permanently occluded; and that the inflammatory process does not range to an undue extent.

The only circumstances which demand deligation of a vein, are those

in which venous hemorrhage interrupts the progress of a deep and difficult dissection, or where loss of life by loss of blood is impending—other means having failed. Supposing this last condition to have occurred—which is not likely—rather than tie the vein itself, employ acu-pressure, or let the surrounding parts be included in the ligature. This, as a means of arresting the hemorrhage, will be both sufficient and safe.

Puncture of a vein, if the vessel be not very large, or placed near the centre of circulation, closes readily by natural hemostatics alone. The flow and force of blood in the wound are comparatively slight; coagulum forms readily, and is not apt to be dislodged. If the puncture be longitudinal, the lips remain in apposition; and simply cohere by adhesion. If it be oblique or transverse, there is more or less gaping of the wound; which, however, soon becomes occupied by coagulum extending between the edges of the venous aperture; and this is strengthened, and supported in its place, by clots formed externally. Plastic formation takes place from the margins of the wound, and is incorporated with the clot; and this new matter becoming organized, the coagulum disappears by absorption. Ultimately a new membranous expansion is constructed—continuous with, and furnished by, the original coats—whereby the chasm is permanently and efficiently closed. The clot obstructing the wound in the vein was, as it were, the scaffolding or mould whereon the new structure was formed; and, when the latter became complete, the former was undone and removed. The external coagulum is also absorbed; the new membrane becomes incorporated with the ordinary areolar tissue; and the part in all respects resumes its normal condition. The venous canal may be obstructed, by excess of coagulum and new formation, at the wounded point; but usually it remains throughout pervious and unchanged; a striking difference from the ordinary result of the corresponding process in arterial tissue. Nay—still in dissimilarity—a venous tube may have been thoroughly obstructed even by plastic change, and have remained so for months—yet opening up afterwards to its former calibre and flow.

Puncture of an artery may, and sometimes does, simply heal in the same way as a vein; that is, by an obstructing coagulum, on and in which a reproduction of the coats is effected; while the canal remains free. But such exceptional occurrences are not to be depended upon; as the comparative impetuosity of the blood's flow in the artery is a fatal obstacle to the general occurrence of such a mode of cure.

Capillary Hemorrhage.

The oozing of blood from the smaller vessels is formidable only by continuance. And, in ordinary circumstances, this need not be, if the right treatment be adopted—pressure, exact and firm, with the styptics if need be. But in a certain morbid state of blood and bloodvessels it is otherwise.

The Hemorrhagic Diathesis.—By this term is meant a tendency to bleeding of an uncontrollable kind, even from a slight breach of surface. This peculiar state of system may be either congenital or acquired. Frequently it is the former, and seems to be hereditary; descending chiefly

not solely, in the male line; disclosing itself at an early age, and abating as age advances. The morbid condition often seems to fluctuate; a scratch at one time threatening fatal loss of blood, while at another scarcely attracting attention. And in some patients distinct periods of remission and exacerbation may be observed. At the latter times, the patient is subject to frequent attacks of pain and swelling, with ecchymosis of the wrists, ankles, and knee joints, attended with fever. These symptoms continue generally about a fortnight.

The diathesis has many points of resemblance to both the scrofulous and the scorbutic; and, like these, it has its marks of indication. The most prominent are—an obvious delicacy of system; usually a fair complexion; a thin transparency of skin; irritability of the circulation at all times; occasional febrile accessions; tendency to ecchymosis from the slightest cause, as also to hemorrhagic oozings from mucous surfaces; every scratch, even in other respects the most trifling, causing alarm, trouble, and sometimes danger, by continuing to bleed.

The cause would seem to be twofold; a morbid condition of the blood, and also of the bloodvessels. The blood looks thin and ichorous. It is deficient in the due proportion of fibrin, and in the power of coagulation; more especially it is incapable, even when wholly at rest, of forming a dense and firm coagulum. And, in consequence of such change in the fluid, there ensues an undue tendency to congestion of the capillaries. So that these vessels, when cut, are not only filled with blood incapable of affording the most important hemostatic means—coagulation; but also contain an amount of that fluid greater than in the state of health.

The capillaries and minute arterial twigs are also at fault. When examined, the latter seem to be devoid of the middle coat; of a thin and feeble appearance, and unusually capacious. It may be that the middle coat is deficient, as some suppose; but more probably it exists, though in a defective state, and certainly much impaired in contractility and tone. In consequence, the other component parts of the natural hemostatics are equally defective as the power of coagulation. The cut vessel contracts and retracts, scarcely if at all; remaining open and unshrunk, passively pouring out its thin contents. Besides, all the coats are friable, and easily torn; and, in consequence, slight bruise produces serious ecchymosis; coughing may induce hæmoptysis; a sneeze brings on epistaxis; and extravasations are not unlikely to follow slight causes within internal cavities.

Thus constituting the hemorrhagic diathesis, we have, besides general irritability of the circulation, blood flowing through dilated and non-contractile tubes, sent thither in greater volume than in ordinary and healthy circumstances, thinner and more fluent than in health, and little if at all able to arrest its own course by assuming the solid form; further, the containing vessels are prone to give way, on application of the slightest violence. Not unfrequently, a febrile condition at the same time exists; and when it does exist, it increases the intensity of the diathesis.

Treatment.—The history and appearance of a patient having made us aware of the presence of this morbid state of the general and circu-

lating systems, every precaution will be adopted to prevent solution of continuity in any way—by wound, tear, or ulcer; more especially during early years. And at the same time, treatment will be adopted to oppose the diathesis and accomplish its removal. It resembles scrofula; and tonics, such as used in that disease, will be of service; patiently persevered with. It also resembles scurvy; citric acid is all-powerful in the one morbid state; it is likely not to be without its good effect in the other. Occasional, smart, purgative doses of sulphate of soda may prove beneficial, in two ways; as purgative and hydragogue, diminishing the amount of serum in the blood; as a chemical salt, seeming to have the effect of increasing the blood's power of firm coagulation.

In the crisis—wound and hemorrhage having occurred—our attention will be directed to the fulfilling of two indications. 1. We endeavour to increase the blood's power of coagulation; more especially its power of forming a dense coagulum. If possible, we would increase the proportion of fibrin. The rapid induction of an inflammatory process might effect this; and the attempt has been made, but with indifferent success. In truth there is no time for such remedies of remote action; and therefore we must content ourselves with those which make the most of the blood such as it is.

Acetate of lead and opium favour coagulation, and calm the circulation; they are to be administered in full and sustained doses. The opium, besides, is supposed to have a tonic and astringent effect on the capillaries; and is specially useful, as formerly stated, in sustaining life under depression from loss of blood. Should these medicines be found to disagree, they may be superseded by the sulphate of alum and potass, in doses of fifteen or twenty grains; or by gallic acid in doses of twelve grains frequently repeated; or by matico in infusion, or by turpentine as the stomach will bear.

Hydragogues, by diminishing the amount of serum in the blood, may contribute to its coagulability. Sulphate of soda, in purgative doses, may not only act in this way; but besides, as already stated, it seems chemically to favour the formation of a dense and firm coagulum. For chemical reasons, however, the sulphate of soda cannot be given in conjunction with the acetate of lead.

At first, we would give nothing in the shape of food or drink. But should our first effort fail, and the bleeding continue, as is not improbable, we would then administer nutritious yet non-stimulant food, in small quantities and frequently; as soup, animal jelly, etc. Avoiding aqueous fluids; plethora of thin blood being far from advantageous. Avoiding also wine, brandy, and all other stimuli, which are adverse to hemostatics—unless when driven to their use, at the eleventh hour, and almost in despair.

In conducting the treatment, one circumstance should never be forgotten; namely, that the chance of success diminishes with the duration of the bleeding; and that, therefore, the first few hours should be occupied by an especially zealous and sustained employment of the requisite means. After excessive loss of blood, the remainder of that fluid, originally poor in fibrin, becomes almost wholly defibrinized; and consequently but little hope of arrest by firm coagulation can then be enter-

tained. In health, as formerly stated, the longer the blood flows the more coagulable it becomes ; in this disease this relation is entirely reversed.

Another rule should not be forgotten ; namely, the propriety of not capriciously and rapidly shifting from one remedy to another, in haste and confusion ; but coolly persevering in one well-selected plan, until fair time has been afforded for this developing its full effect.

2. The second indication is directed to the state of the part. Our trust is in styptics and pressure ; of the former, two are specially available—strong tincture of matico, and the solution of the perchloride of iron. For applying pressure many ingenious contrivances have been employed, suited to various localities whence such hemorrhage is likely to come—the majority directed to the case after tooth-extraction. But we believe that all of these are very inferior to “animal pressure,” applied by the finger and thumb of the surgeon—followed up by those of intelligent assistants, in suitable relays—so as to maintain a continuance of such compression as is exact and uniform, yet moderate. Probably the best medium of compression is a dossil of lint or charpie, steeped in the styptic ; and renewed whenever it becomes soaked with the discharge. A great amount of pressure must be carefully avoided ; for both part and system are intolerant of this. Ecchymosis, sloughing, and ulceration, with much constitutional disturbance of a low and irritable type, will certainly follow ; and in a short time blood will burst forth, from a wider surface, and with a more willing flow than before.

The actual cautery, enjoying a general reputation of being at once the most severe and most powerful of local hemostatics, has naturally been employed in desperate cases ; but invariably with an evil issue ; as can, indeed, be readily understood. The slough or eschar which is formed may arrest the flow for a time, while it is yet adherent ; but the process of detachment is, in such cases, both an early and a rapid one ; and the ulceration, opening up parts devoid of plastic power, certainly reinduces the hemorrhage—and that too in an aggravated form. In the hemorrhagic diathesis, the actual cautery should never be employed. There is an intolerance of the remedy itself ; and besides, the parts are by its use rendered incapable of bearing the subsequent application of pressure.

Deligation of the principal arterial trunk cannot but fail in such cases. The oozing is from capillaries ; and their circulation, it is well known, will not be sufficiently affected by any such procedure.

Treatment having failed to arrest, and the condition of the patient having become almost hopeless, one effort more may still be made for his life ; by transfusion.

The Effects of Loss of Blood.

Sudden Death from Profuse Hemorrhage.—Examples of this accident are interesting to the surgical pathologist, merely in a scientific point of view. A man, in committing suicide, cuts deeply into the neck ; wounding the large vessels ; and almost immediately falls down a corpse. The murderous instrument may be found firmly grasped in the clenched

hand ; a convulsive spasm of the muscles of the whole body having preceded death. Or the man may have died without a struggle ; and the weapon is found lying beside him, having fallen from his hand when the wound had been made.

The rapidity with which death arrives is, of course, dependent on the amount of blood lost in a given time, and on the previous state of the constitutional powers of the patient. The influence of this latter circumstance is undoubtedly extremely insignificant, in the class of cases now alluded to. But it will come to occupy a more important place, when we consider the effects of a continued loss or draining of blood from the system. The former circumstance, viz., the amount and rapidity of the hemorrhage, has an obvious bearing ; for if the bleeding be not excessive, the surgeon may by timely measures rescue his patient from death. And it is in cases where a short time (say a few minutes) elapses before the fatal event, that we have occasionally an opportunity of studying its circumstances.

The history of such cases is extremely short. In surgical practice, they are most frequently exemplified in wounds, in secondary hemorrhage, and in the bursting of external aneurisms ; in the practice of the physician, in the bursting of internal aneurisms, and in mucous hemorrhages ; and in the practice of the obstetrician, they are occasionally but rarely seen, in cases of uterine hemorrhage connected with advanced pregnancy or labour. The surface of the body becomes deadly pale and cold ; the voice is altogether gone, or almost inaudible ; syncope occurs ; and, probably in convulsion, the patient dies. If death does not take place immediately, the first faint may pass off ; the eye becomes glazed, and the pupils are dilated, the mouth grows dry and cold, thirst is urgent, the patient sighs oppressively, and may be able to toss his head to relieve the extreme feeling of uneasiness which oppresses him. Generally he retains his mental faculties to the end ; a last attack of syncope supervenes, and carrying him off either quiet or convulsed.

Effects of a Continued Loss of Blood.—A man may fall down suddenly in a faint, from accidental loss of blood, without sustaining from that loss any serious injury whatever. Either the syncope itself, or timely outward assistance, arrests the hemorrhage ; he recovers from the faint ; and nothing of any importance results. But if within a short time this hemorrhage is again and again renewed, it is no longer innocuous. Recovery from the state of fainting is then not perfect ; but may be accompanied with more or less delirium, or with an excessive feeling of anxiety, or with jactitation, violent rigors, or even convulsions ; and, in the severest cases, with involuntary evacuation of the bladder and bowels. Further, the depression immediately resulting from the hemorrhage comes to be followed by a train of symptoms, to which the name of fever, or the *fever of reaction*, has been applied.

This state of the circulating system becomes occasionally a formidable and difficult complication. A patient has received serious injury of a limb, attended with much hemorrhage. And in deciding upon the propriety of at once operating in such a case, or of delaying interference, we must consider not only the nervous and constitutional shocks which the patient has received ; but also whether or not the organs of circula-

tion can safely continue their functions, under the additional but comparatively slight loss of blood caused necessarily by the operation. Many cases are on record where they have suddenly failed under such circumstances.

Nothing can be stated, absolutely, as to the amount of hemorrhage which is necessary to induce the fever of reaction ; neither can any particular period for its accession be specified. In these particulars, there is every possible variation ; according to age and constitution. The young and the old, the weak of all ages, and generally those of a sanguineous temperament, feel most acutely all the different effects of profuse bleeding.

The fever of reaction speedily disappears, if hemorrhage is quite arrested ; but if a drain of blood still continue, the fever certainly returns, though with less violence ; and may be repeated again and again, till at last it subsides into a state of gradual sinking followed by death.

This fever of reaction is characterized by extreme weakness, combined with great excitement of the circulation. The pulse is frequent, but soft and jerking ; giving to the finger the sensation of a violent propulsive stroke from the excited heart, acting on the contents of an imperfectly-filled vessel. There is generally a painful feeling of pulsation in all the large arteries, and especially in the aorta ; also headache or giddiness, sometimes low delirium, intolerance of light and sound, hurried breathing, and great feeling of anxiety in the chest.

The Treatment of the constitutional effects of loss of blood is extremely simple in its plan. The patient is to be placed in a large airy room, in a recumbent posture, without pillows under the head. Stimulants should be administered as circumstances may seem to require. And if transfusion is considered necessary, it should be performed without delay (p. 226).

If the convulsions and delirium, which are often present, seem to be connected with congestion in the head, some simple derivatives and counter-irritants may be necessary ; as dry-cupping to the nape of the neck, if depression of the pulse is not extreme ; or the application of sinapisms, or even blisters, to various parts of the body. But, under all circumstances, the use of stimulants is to be continued ; forming, as it does, our chief indication. At the same time, the patient should be freely supplied with mild nourishment. And, as already stated, a prudent use of opium will be found of the greatest value (p. 226). Such medicines as camphor, musk, ether, etc., may also be useful ; to allay the nervous excitability of the heart.

Anæmia.—When loss of blood is not at once carried to such an extent as seriously to affect the system, but has been continued for a long time, or frequently repeated, it gives rise to a series of constitutional symptoms which are classed under the term *Anæmia*. These symptoms, although in themselves apparently of a serious and alarming nature, are chiefly interesting to the surgeon as indicating the effect of continued sanguineous discharge. He knows that by removing the cause of the hemorrhage, he will not only cure the original complaint, but also afford the only sure means of relief from these secondary constitutional

symptoms ; which may have seemed to the sufferer by far the most important and distressing part of the case.

At the same time, the anæmic state, when it exists in an aggravated degree, is itself a matter of great importance. It forms a strong predisposing cause of various diseases ; more interesting to the physician, perhaps, than to the surgeon. And the source of this increased tendency to certain morbid states of the system, is to be found in the altered state of the blood. When a single hemorrhage occurs, by accident or intention, the only subsequent change to be discovered in the blood is a diminution of the number of red corpuscles. But if bleeding be long continued, or often repeated, the blood is found impoverished not only in the amount of its coloured globules, but also in that of solid matter in the liquor sanguinis. It has in fact become watery. The red globules, the fibrin, and the albumen, are all in abnormally small proportions. It is this state of the blood which is characteristic of anæmia ; and which renders the patient liable to passive dropsy, in any of the shut serous cavities, or in the general areolar tissue ; as well as to morbid congestions in the parenchymatous organs. And it is well known that these last may, under any accidental exciting influence, become the starting point for chronic inflammatory disease of a formidable kind. The inflammatory products, in such circumstances, have a tendency to some low form of development. And hence, in the lungs and kidneys, their most frequent sites, we find the morbid process prone to tubercular and unhealthy fibrinous formation ; in the latter case producing a change of structure characteristic of some forms of Bright's disease.

Besides, the state of anæmia predisposes strongly to attacks of epileptic convulsions, syncope, palpitation of the heart, asthma, hysteria, colic, partial paralysis, chorea, and a long list of other functional diseases ; or diseases of innervation.

The constitutional symptoms of anæmia are a pale, waxy appearance of the countenance ; pallor of the lips, and mucous membrane of the mouth ; weakness of sight, or even amaurosis ; vertigo, or giddiness in the head ; a weak, and easily excitable pulse ; dyspnœa after the least exertion ; tendency to sickness and vomiting ; irregularity of the bowels ; weakness of the limbs ; and a general feeling of excessive lassitude.

In surgery, cure is obtained by direct interference ; namely, by putting an effectual stop to the sanguineous discharge. If a pile or polypus has been bleeding, it is tied, and taken away ; if the blood has proceeded from an open ulcer, in any of the mucous passages, it is cauterized and healed up. At the same time, suitable medical treatment is employed to hasten and establish convalescence. The principal remedies, with this view, are bark and iron, as tonics ; and opium, as a sedative, in small doses ; or hyoscyamus, camphor, etc. On a well-managed generous diet, however, our chief reliance should be placed ; as, after all, the best tonic and restorative.

CHAPTER X.

AFFECTIONS OF INTERNAL ORGANS IN CONNECTION WITH SURGICAL DISEASE.

THE not unfrequent coincidence of serious internal diseases with affections apparently of a purely surgical character, is a circumstance of the greatest interest and importance to the practitioner, and well calculated to impress upon him the necessity of some degree of knowledge of his art in all its branches. Without such knowledge, he can never be secure in determining upon, or in performing any operation ; or even in the treatment of the most ordinary injuries. For it has been shewn by multiplied experience, that there is no wound, from phlebotomy to amputation ; no concussion, from the smallest bruise to the most frightful fracture ; no disease, from that of a finger to the caries of a hip-joint or vertebral column,—which is not very liable to be preceded, followed, or in some way or other connected, with disease of vital internal organs ; so modifying diagnosis, prognosis, and treatment.

The coincidence of internal with external diseases, may occur under a great variety of circumstances. It may be purely a coincidence ; or one of the diseases may stand to the other in the relation of a cause ; or again, there may be an antecedent circumstance to which all are to be ascribed, as happens in most constitutional disorders. In these cases, the effect of the internal on the external disease may be such as to modify its whole characters, and thus to make itself obvious to the most unwary and unobservant practitioner ; or, on the other hand, its influence may be so insidiously exerted as not to be readily appreciable, till the shock and subsequent reaction of some great operation, or the supervention of some accidental febrile attack, shews the real weakness of the vital powers, and demonstrates that more tolerance of injury has been looked for than the state of the internal organs warranted. We may illustrate this subject under the following heads :—

1. *Internal diseases may concur accidentally with external disease.*—In this case they are commonly chronic, or at least of older standing than the surgical affection. It is well known that a large proportion of individuals dying of any disease, whether medical or surgical, especially if of advanced age, of dissipated habits, or otherwise exposed to the causes of morbid change, exhibit marks of either obsolete or progressive disease in vital organs, contracted at an earlier period than the fatal affection. Such departure from health may include a great variety of organs. In this country the most common diseases are those of the lungs, particularly tubercular affections ; the traces of which are found in a very large proportion, probably even in a majority of persons dying in ad-

vanced life. Next to the pulmonary lesions, diseases of the kidneys and of the heart, in both sexes—and, in women, of the uterus—are the most frequent; and important disorders of the brain, liver, intestines, and spleen, are far from being of rare occurrence. Many of these affections are found to have undergone cures; others may be in a state of progress at the time of death, and yet apparently unconnected with the fatal event; while, in many cases, they have obviously hastened this, either by imparting to the fatal disease a more formidable character, or by acting as either its predisposing or exciting cause.

It is obvious that the chances of an operation, or other violent interference with the natural condition, as likewise the prognosis and treatment of many external maladies, must be constantly modified, and that to a very considerable extent, by such antecedent circumstances. The presence of Bright's disease of the kidney, of tubercular phthisis, of organic disease of the heart, of chronic affections of the brain or liver, may not be inconsistent with a certain amount of health, and enjoyment of life, under the usual conditions; but they form a most dangerous complication of any severe injury, and are often sufficient to render the chances of an otherwise justifiable operation worse than those of the disease it is intended to remove. Hence, every patient about to be subjected to severe operative procedure, should be submitted to a medical examination, as satisfactory as his state will permit; and the surgeon's hand should be guided by as ample a knowledge as possible of his patient's previous constitution, diseases, and predisposition. Even if the operation should be determined upon, in unfavourable circumstances, the precaution will often enable us to foresee and guard against calamities, which might otherwise have been unnoticed and unlooked-for till too late for either prevention or relief.

Internal diseases may of course arise accidentally, during the treatment of surgical cases; presenting the most varied forms, and producing the most varied effects. It is impossible, however, to give any general rules applicable to such cases; which must be met by the care, vigilance, and general knowledge of the individual attendant.

2. *The internal disease may be the cause of the external.*—Examples of this are familiar to every practitioner. They often come first under the eye of the surgeon, on account of the predominance and easily appreciable characters of the external symptoms, as compared with the more latent internal disorder. Nevertheless, to the latter, usually, attention must mainly be directed in treatment; while the other is of course not neglected.

Thus an abscess in the groin, or beneath the fascia of the thigh, may be connected with deep-seated disease of the vertebral column; and may be readily mistaken, by the unwary or ill-informed surgeon, for a mere external affection. Abscesses in the root of the neck may communicate with the lung—though this is rare; less seldom they lie close upon, or are found in connection with, the aorta, or some other great vessel, which may be at the same time the subject of disease. An abscess of the thoracic parietes may appear to be localized there, and yet may have been formed in consequence of a collection of matter in the pleura. An inflammatory affection of the abdominal parietes, leading to abscess, may result from

disease in the liver ; or may be in connection with the intestines—ultimately causing faecal fistula. Many ulcers also, especially of the indolent kind, owe peculiar characters, or even their existence, to Bright's disease of the kidney, or to organic affection of other internal viscera ; a circumstance which of course very much modifies the prognosis, as well as the treatment. Absorption of the sternum, and other diseases of external bones, may be caused by aneurisms pressing upon them from within ; the non-recognition of which might lead to immediately fatal consequences. Finally, functional disorders requiring or appearing to require surgical aid, may be essentially dependent on organic or other internal affections ; as spasm of the larynx, possibly requiring tracheotomy—in children dependent on intestinal irritation, in adults on aneurisms or other tumours interfering with the pneumogastric nerve.

3. *The external affection may precede and give rise to the internal.*—The great number of secondary diseases which are liable to follow external inflammatory affections, and operations, is well known to surgeons. Experience has shewn that a very large proportion of deaths after amputation are caused by that peculiar poisoning of the blood—with its terrible consequences—usually termed Pyæmia ; abscesses in various internal parts accelerating the fatal issue. The same symptoms not unfrequently arise from very slight external lesions, such as wound of a vein in bleeding, simple fracture of a limb, or some accidental breach of surface, in itself most trivial. The effect of many poisoned wounds, also, is a species of spreading inflammatory mischief which readily extends over a large surface, and involves very frequently internal organs in its progress ; and the same thing may be said of erysipelas, which not unfrequently undergoes an extension or transmutation into an affection of some internal part.

The special secondary accidents to which particular surgical operations and diseases are liable, will receive full consideration hereafter. But, in the meantime, it is to be noticed, that almost all secondary inflammatory attacks are apt to present remarkably insidious characters ; being masked partly by the constitutional symptoms which always follow an operation, partly by the peculiar character of the inflammatory process, and often also by the asthenic condition of the patient, and the attention necessarily directed to the external and primary affection. Such diseases, therefore, require particular care for their recognition, and usually also very great skill and circumspection in treatment.

4. *The external and internal disorders may be produced by a common cause.*—This is perhaps the most usual mode in which internal diseases occur in surgery. It may indeed be doubted, whether almost any inflammatory attack, except such as is the effect of injury, external or internal, can be viewed as being altogether unconnected with some constitutional source ; and the cause which renders an individual liable to one disease, not unfrequently brings others in its train. Instances of such association of diseases are of constant occurrence. Thus aneurism of an external artery is, very commonly, but one indication of disease in the whole arterial system ; and if, in this case, an internal aneurism be detected—say, in the aorta—not only is the prognosis as regards the success of an operation on the external aneurism much modified, but the

propriety of undertaking it at all is rendered very doubtful. Another instance of a disease of this kind is senile gangrene; which often depends on a wide-spread affection of the arterial system.

A local disease may be such as, from its position alone, to involve both external and internal organs simultaneously. Thus caries of the petrous portion of the temporal bone may produce an inflammatory affection of the external ear, at the same time that it is causing dangerous disease of the membranes of the brain; and attempted cure of the former affection may only expedite the destructive course of the latter. Again, a local disease may have become so connected with the habit, as it were, of an individual constitution, as to render its sudden removal dangerous. In some instances, for example, the removal of piles has given rise to dangerous hemorrhage into internal organs, or to other disease which had been restrained by the local discharge.

But among the cases requiring the greatest caution, under this head, are those of external injuries; especially when of a violent or concussive character. There is always a fear, in such cases, that an internal organ may be injuriously affected; and an external wound or fracture may be a matter of small consideration indeed, when compared with a laceration of the brain, liver, or other vital part. Deep-seated lesions are very apt to be overlooked in the first instance, from the shock which attends the injury masking all peculiar sensations; and they should be made the subject of very careful inquiry, so soon as the patient has recovered his consciousness.

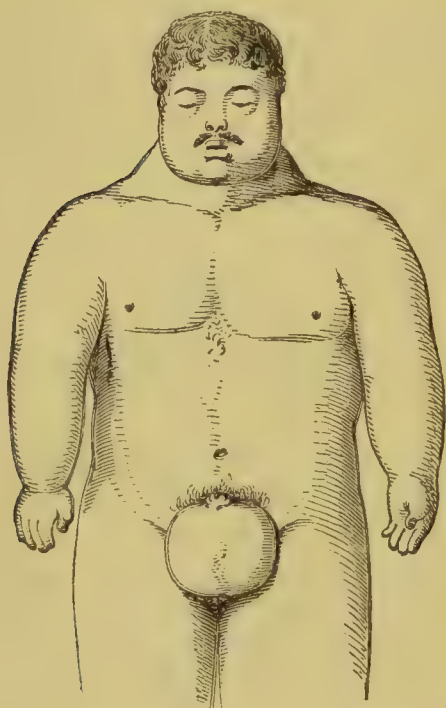


Fig. 102.

Even when not produced by extreme violence or concussion, wounds may be inflicted in such a manner as to cause effects of a serious character on internal organs. In illustration of this, we may instance the formidable effects in wounds of some of the greater veins, arising from the admission of air into the circulating blood; a lesion which has often been followed by instantaneously fatal consequences, during the extirpation of tumours, or other operations in the axilla or neck. Thus, too, wounds of the lung are apt to be followed by many serious and fatal accidents; the admission of air to the pleural cavity being occasionally productive of immediate death, especially when there has been previously a diseased state of the lungs on one or both sides. The state of general emphysema of the areolar tissue—its distension with air—which is apt to supervene on wounds of the air-passages, occasionally results in serious consequences; producing frightful inflation of the whole body,

Fig. 102. General emphysema of the whole surface, after wound of the right side of the chest. The patient was a *light dragoon*. After Larrey.

and requiring prompt surgical interference to prevent suffocation. Injuries of the abdomen may lead to communications of the intestinal cavity with either the peritoneum or the external surface ; producing, in the first case, peritonitis of a violent and uncontrollable description ; in the second, a fistulous opening, which can only be closed by operative procedure.

CHAPTER XI.

AFFECTIONS OF THE INTEGUMENT.

ERYTHEMA.

By this term is meant an inflammatory process, of a low grade, and tending to spread by continuity, occurring in the mere surface of the integument ; chiefly resident in the *rete vasculosum cutis*.

The *Symptoms* are heat, pain, and tingling in the part ; a bright red blush ; sometimes marked by an abrupt and distinct border, sometimes gradually lost by diffusion ; more or less dryness, by interruption to normal exhalation ; a very slight tumescence of the red surface, scarcely appreciable by the eye, yet capable of being distinctly felt by the finger lightly applied ; increase in susceptibility of external impressions in general ; and tenderness on pressure, which produces transient whiteness, with slight as well as temporary depression. These symptoms, having continued for a day or two, may simply decline ; the part becoming gradually less swoln, red, tender, and painful, and resuming its wonted function. Numerous scales of cuticle become detached, and fall away ; and the result is usually termed Resolution, by desquamation. Or, less frequently, vesication occurs ; the vesicles forming slowly, and to no great extent ; filled with a watery straw-coloured serum ; either simply drying, or bursting and then crusting over ; the uneasy feelings, thereafter, gradually subsiding ; and desquamation again constituting the last part of the process of cure. The constitutional symptoms may precede or accompany. Sometimes they are sthenic, and of the inflammatory type ; slight and transient ; the consequence of the local disorder. Sometimes they are of the form of constitutional irritation ; preceding rather than accompanying ; and oftener the cause than the effect of the local ailment.

The *Cause* may be either local or constitutional ; external or internal. Often it is external, and local ; a puncture of the finger, for example, in dissecting, nursing, washing ; probably with a state of system not ill-disposed towards the assumption of morbid change. The injured part undergoes the inflammatory process ; and this, instead of remaining of a circumscribed character, spreads by continuity. The constitutional disorder is then of secondary occurrence ; slight, of the inflammatory type, and soon passing away.

Or the cause may be internal, and constitutional. The *primæ viæ* are sadly disordered ; there is much bilious derangement, and serious febrile disturbance ; during the progress of this febrile condition, an erythema breaks out on some part of the surface, spreading more or less ; and, on its appearance, the general disorder undergoes a marked diminu-

tion. It is, as it were, an example of Nature's mode of relief, by counter-irritation and derivation. Or the patient is labouring under a low typhoid fever ; and, during its progress, an erythema forms ; sometimes with relief—though not so marked as in the former example ; sometimes seeming rather to embarrass the system still more, and increasing the tendency to prostration.

Treatment varies, according as the erythema is reckoned the disease itself ; or only a symptom of another disease, far more important. If the cause be local and external, with constitutional disorder slight and secondary, treatment is direct ; as for the disease. The part is kept at rest, and fomented ; or it is lightly pencilled over, either with a solution of iodine, or with the nitrate of silver. The latter, either solid or in solution, is probably the preferable application ; seeking only the first effect ; blackening and non-vesicant. Antiphlogistic regimen is enjoined, a purge administered, and perhaps aconite or antimony. Resolution is obtained.

If, however, the cause be internal and constitutional, with the general symptoms formidable, and antecedent as well as concomitant, we seek no resolution. As small-pox and scarlatina have their eruptions, are relieved thereby, and become much aggravated by their repulsion ; so fevers—simple, bilious, typhoid—sometimes have theirs ; of an erythematous character. And the use of repellents is not more foolish in the one case than in the other. Our principal attention will be directed to the general disorder ; contenting ourselves with palliation of that which is local. Occasional fomentation relieves the unpleasant feelings in the part ; and, at the same time, rather encourages derivation than otherwise. Or the surface may simply be dusted with flour, starch, or oxide of zinc powder.

When we are especially desirous that a spreading erythema shall be turned aside from certain parts, the nitrate of silver, still used lightly, is of service ; not applied to the erythematous part, but in its vicinity ; not as a resolute, but as a limiting agent.

ERYSIPELAS.

Erysipelas—of which disease Erythema may be considered as the lightest form—denotes the inflammatory process, resident in the superficial textures—skin, and subcutaneous areolar tissue ; prone to spread, and partaking more or less of the asthenic type. We shall treat of three kinds—the Cutaneous, or Simple—the Cellulo-cutaneous, or Phlegmonous—and the Subcutaneous ; with the following varieties—Œdematous, Bilious, Erratic, Periodic, and Hospital.

Simple or Cutaneous Erysipelas.

An inflammatory process pervades the entire true skin ; and is more progressive than in erythema. The ordinary symptoms, therefore, of such change are more prominently developed. Redness is greater ; often of a rosy hue ; and hence the vulgar name of the disease. Swelling is

greater; appreciable by both sight and touch. Heat and pain are of a burning kind, and often intense. Pale dimples, by compression, are more distinct, and less transient; though still soon passing away, by reflux of circulating blood and displacement of serous product.

At first, there is no actual tension; the swelling is slight, gradual, serous, and soft. Sometimes, however, when the process is especially acute—the case, perhaps, threatening to pass into the second form of the disease—swelling is fibrinous, considerable, and rapid; and more or less tension occurs. Ordinarily, as the moderate process steadily advances, serous accumulation occurs superficially; elevating the cuticle by vesication—sometimes extensive and continuous, sometimes in the form of numerous small blisters. On the cuticle giving way, spontaneously or by puncture, serous fluid escapes; usually with relief to the symptoms. But not unfrequently, similar serous accumulation occurs on the internal, as well as on the external aspect of the cutis, and occupies the subcutaneous areolar tissue, which though originally free, now becomes involved in the morbid process; and, if this accumulation be both copious and rapid, the swelling becomes tense as well as much increased, and the symptoms are aggravated accordingly.

Very generally, a strong tendency is evinced by the mucous membranes of the respiratory and alimentary systems to sympathise with the cutaneous surface. Not unfrequently, they seem to undergo, simultaneously, a somewhat similar affection; and this without metastasis.

Like erythema, erysipelas may simply resolve. Or vesication occurs; either alone, or along with gradual accumulation of serum subcutaneously. The vesicles burst, or are artificially emptied; the subcutaneous fluid is absorbed; the symptoms abate; and the part quickly regains its normal condition, by a process which may be still termed Resolution—by vesication. Such recovery is not always uniform and general. It may be partial, and successive; the part first attacked becoming first restored; while that more recently involved, in the line of extension, is yet in the nascent and acute stage.

Sometimes, however, the process does not recede, though vesication occur. The vesicle bursts, and the serum is discharged; but simple desiccation does not follow. A purulent discharge appears; the inflammatory process having advanced to the third degree. And a similar formation may occur on the internal aspect as well; either at the same time or subsequently; causing subcutaneous abscess.

Such abscess, however, is comparatively rare; and only forms in the more intense, or neglected cases of simple erysipelas. It is neither early nor diffuse, as in the phlegmonous form; but surrounded by more or less of the usual plastic product, and consequently amenable to ordinary treatment. Should incision be delayed, however, sloughing of integument is not unlikely to follow—the imperfect plastic limitation having given way, and so permitting an undermining of the tissue which has been itself acutely inflaming.

But suppuration, in simple erysipelas, may be still more secondary. After the ordinary symptoms have satisfactorily subsided, and almost or altogether disappeared from the general surface affected, it may happen, in those especially of feeble constitution, that inflammatory reaccession of a

more intense and circumscribed character occurs, either in some neighbouring locality, or at one or more points of the part originally attacked. In erysipelas of the face, for instance, the lower eyelids often thus suffer. The returned process is acute; suppuration is early and copious; and, in the course of but a few hours, a considerable abscess may have formed. It is under such circumstances, that sloughing of the integument is most especially probable; if an evacuating incision be delayed.

The ordinary exciting *Cause* of simple erysipelas is external injury; often slight; applied during a disordered state of system, favourable to inflammatory accession. In most cases, therefore, constitutional symptoms may be said to precede the local. But the antecedents are not inflammatory; they are either simply febrile, or, more frequently, those of stomachic and biliary derangement; foul tongue, bitter taste in the mouth, headache, tendency to shiver, thick turbid urine, sickness and bilious vomiting, etc. On occurrence of the local change, the general disorder, as usual, assumes more or less of the inflammatory type; then gradually subsiding, according as the local disease and its constitutional predisposing cause yield to suitable treatment. When the former is comparatively slight, the antecedent constitutional disorder is often relieved by its appearance; and can scarcely be said, at all, to acquire the inflammatory type.

In some few cases, the cause would seem to be chiefly local. Then there are no precursory general symptoms; the constitutional disorder is secondary, and of the ordinary inflammatory character. The light and gentle modern treatment of wounds, being opposed to inflammatory accession, is beneficial; not only in favouring speedy reunion, but also by avoiding the risk of erysipelas.

Often, the state of the atmosphere seems to exert a powerfully predisposing influence in favour of the accession of this disease. And, hence, we not unfrequently find it assuming an epidemic form during spring and autumn; when atmospheric vicissitudes most prevail. When such is the case, we also find the constitutional symptoms, whether primary or secondary, tending to shew very plainly the asthenic character; more especially as the majority of those attacked are of already weakened frames, by dissipation, poverty, or previous disease.

Habitual exposure to heat, as in cooks and furnace-men, predisposes to erysipelas; by occasioning frequent sanguineous determination to the surface. And frequent irritation of the skin, by friction or otherwise, has a similar effect; as in sailors, by the rubbing of hard canvas trousers, often saturated with the briny element of their vocation. Exposure to cold, by its reactive effect, may predispose to erysipelas; in those parts chiefly implicated—the hands and face; as in coachmen. But it is to be remembered, that in such cases, as well as in those of habitual exposure to heat, other causes may be in operation, especially in the lower ranks; namely, habits of intemperance.

When erysipelas has once occurred, both part and patient remain liable to its return, from the application of a comparatively slight cause; and are to be guarded accordingly. Many persons, particularly females, are the subjects of regular periodical attacks; usually slight. And, though very amenable to the usual treatment, these are not to be rashly

aborted ; their occurrence and ordinary course sometimes seeming to be a natural relief from more serious impending disorder of the system.

Prognosis varies, according to circumstances. The more extensive the erysipelas, the more grave are the constitutional symptoms, and the more serious is the case. If situate on the face, head, trunk, or genitals, it is more dangerous than on the extremities. If constitutional symptoms are both antecedent and concomitant, and of a marked asthenic type, the case is one of danger. In early childhood and advanced age, when the balance of life is very delicate, and easily turned, erysipelas may operate much to the patient's disadvantage, and even terminate fatally. Previous habits of intemperance, atmospheric influence of a sinister kind, and exhaustion by former disease, engender intolerance of erysipelas, even when apparently slight ; and cloud the prospect of speedy and satisfactory cure.

Treatment.—This must not be abortive or ectrotic ; whether the disease be of local or constitutional origin. If the former, sudden arrest is apt to be followed by speedy appearance of the inflammatory process in another part ; it may be in the integument, or it may be in the lining membrane of an important internal cavity. Metastasis occurs, and often unfavourably. If the latter, natural relief to an oppressed system is thwarted ; and constitutional disorder is not only not relieved, as it should have been, but becomes perhaps seriously aggravated. Treatment, then, will not consist of direct repellents ; but of such local means as favour gradual resolution ; invariably accompanied, and if possible preceded, by search for and removal of the apparent cause.

In most cases, as already stated, the predisposing cause is derangement of the primæ viæ. If an emetic be not otherwise contra-indicated, it is an excellent commencement of practice ; unloading the stomach, promoting the flow of bile, and usually inducing profuse perspiration from the general surface. It is followed by a purge, usually of a mercurial kind ; performing the same good office for the bowels which the emetic has done for the stomach. The antiphlogistic regimen is enjoined ; and if the constitutional symptoms be sthenic and inflammatory, the simpler antiphlogistic remedies may be given—as weak doses, in aqueous solution, of aconite or belladonna ; or small doses of antimony with Mindererus' spirit. Soon, however, these will be well superseded by the chalybeate treatment ; and in many cases, indeed, this may be begun almost from the very first. The tincture of the sesquichloride of iron is given, in full and sustained doses : 20-30 drops every two hours, for an adult ; 15-20, for an adolescent ; 3 for a child of one month : the dose of course watched, and varied according to the result. At first it may seem to act unpleasantly as a stimulant, causing tightness in the forehead with increase of other feverish sensations ; but these usually disappear with the occurrence of sweating and diuresis.

The iron may generally be continued, in greater or less amount, throughout the entire course of the disease, and for some little time afterwards ; apparently with the effect of obtaining a more speedy and satisfactory cure than otherwise would have been the case, and to a large extent preventing those troublesome secondary abscesses to which allusion has been made. Indeed, since fully adopting the chaly-

beate treatment, I have met with comparatively few of these unpleasant sequelæ.

Local applications consist of warm fomentations, whereby the ordinary antiphlogistic results are obtained. The vulgar prejudice which at one time existed against "wetting the rose," has long since subsided. One mode of wetting is indeed highly prejudicial; that is, by cold repellent lotions; more especially when the disease is so situated—on the head, face, or trunk—as to render metastasis not only probable, but certain to prove untoward when it does occur.

When tenderness, heat, and pain of the surface are especially great, fomentation may be beneficially medicated; as by acetate of lead and opium, in weak solution. In the slighter cases, a comfortable sensation follows dusting the part thickly over by a light and fine powder—as flour, starch, magnesia, or oxide of zinc; probably on account of the stimulus of atmospheric influence being thus removed. But, in most cases, it is better to dispense with such an envelope; considering it to be of much higher importance to maintain a constant and complete surveillance of the varying condition of the part.

To minor examples, the simply antiphlogistic use of nitrate of silver is applicable. But it, too, is objectionable, on the score of concealing the true state of the part. And besides, it sometimes seems to have the effect of, as it were, driving the disease from the skin to the subjacent tissue, and so favouring suppuration; as if inducing metastasis from the superficial to the deeper strata, and concentration there. We may avail ourselves of its circumscribing power, in any case; as in erythema. But its direct employment we would consider applicable chiefly to erythema; and, in erysipelas, to the minor cases only; namely those which, besides having little intensity, are of limited extent, and situate on the extremities. When employed, it is used in the form of strong solution, laid freely on; so as not only to cover every part of the erysipelatous surface, but also to include a border of sound skin, to the extent of two or more inches around. And as the disease spreads, the application should keep pace with it, by renewal. My own experience of this remedy forbids its direct use in all cases of erysipelas affecting the head or face; and, while limiting it to the minor forms of the disease everywhere, finds a special favour for it in affections of the extremities.

Some recommend the use of ferruginous lotions to the part from the very commencement; the sulphate or tartarized iron being preferred for this purpose. The application of a blister to the affected part constituted the favourite treatment of Dupuytren.

In some cases of erysipelas, which are from the first acute, and obviously progressive, notwithstanding the suitable treatment by iron and otherwise, local blood-letting may be advisable. For this purpose, leeches are sometimes employed. But they are apt to do more harm by the irritation of the bites, than good by the abstraction of blood. Their suction seems to be inimical to adhesion, and favourable to suppuration and ulceration, even in a previously healthy part. Punctures, rapidly made with the point of a lancet, are preferable. They may be more painful at the time, but the smarting soon ceases; the inflammatory process declining, they usually heal by adhesion; and, on subsidence of

swelling, the cicatrices are so minute and faint as to be almost or wholly invisible. They are more efficient, as antiphlogistics, than leeches, drawing the blood more copiously and rapidly ; less apt to irritate ; and seldom if ever leaving any mark at all approaching to deformity. They fulfil a twofold indication. The majority are made to implicate only the *rete vasculosum* ; their object being loss of blood. A few—and only a few such are necessary, the spaces of the areolar tissue freely inter-communicating—penetrate more deeply to the subjacent tissue ; their object being to drain off the serous fluid ; so favouring vascular relief, and at the same time preventing the occurrence of untoward tension. Hot fomentation is assiduously employed, for some time after infliction of the wounds ; being favourable to both indications. And if the flow of blood be not altogether satisfactory, it may be increased by the temporary application of a ligature on the cardiac aspect of the part.

This practice, by puncture, may startle those who are practically unacquainted with it ; by its apparent severity. But this is only ideal. We grant that in one point (the infliction of temporary pain), it may be worse than leeching ; but in every other it is much and truly superior. Alarming it may be, to the timid patient ; but it is quickly over. A few seconds suffice ; and the relief is both satisfactory and instant. In the more severe cases which demand its use, the pain of infliction is often the least. The acute pain, already existing in the part, masks that of the punctures ; in the same way as the operation of scarifying tense and painful gums seems, not unfrequently, to be agreeable rather than otherwise to the teething child.

During treatment, the erysipelatous part should be retained in an elevated posture, for obvious reasons ; when that is practicable.

When abscess forms, whether during acute progress of the disease, or of secondary occurrence, an early opening is highly advisable ; to save both skin and subjacent tissue. For although the abscess be not diffuse, and may be somewhat limited by plastic product, yet its tendency to rapid extension is greater than in ordinary circumstances. The affection is, more or less, asthenic.

So soon as the disease has begun to subside, there is often a necessity not only for discontinuance of general antiphlogistics, but for recourse to support of the system ; as in the old, or in those of previously debilitated frame, and when the affection is of an epidemic character. Wine is given, at first cautiously ; with as much plain nutritious food as the stomach can easily digest. And be it remembered, that such tonic general treatment is, in such cases, not incompatible with continuance or resumption of local antiphlogistics ; should these be demanded by the state of the part.

Sometimes wine must be given from the first. In no other way may old or otherwise worn-out frames make head against the asthenic constitutional symptoms, which sometimes not only accompany but precede the attack. To save texture, and arrest disease, it may be necessary to puncture and poultice ; while, to maintain life, it is at the same time essential to administer stimulants internally. On reflection, the practice will not be found so paradoxical as it may at first seem.

In no case should fomentation and poultice be long continued ; seldom, if ever, beyond two or three days ; otherwise the parts become sodden and relaxed, and made prone to unhealthy suppuration. After the inflammatory process has fairly begun to pass away, gentle and uniform support by bandaging is expedient ; preventing congestion, removing the tendency to œdema, and hastening restoration to the normal sthenic condition.

Cellulo-Cutaneous, or Phlegmonous Erysipelas.

This is an infinitely more serious affection. The inflammatory process is intense, and rapid in its progress ; and a plurality of tissues are involved, from the first. The skin and subcutaneous areolar tissue are both acutely inflamed ; serous and fibrinous inflammatory product collect in quantity, and tension ensues ; swelling is great and rapid ; a limb, not unfrequently, is enlarged to almost twice its normal girth ; the skin is red, hot, tight, and shining—shewing no rugae, but smooth and glistening ; pressure is very painful, and the part feels as if converted into brawn. Vesication often takes place, in a broad extended form ; as in the first effect of a blister. It is rather a favourable sign than otherwise ; for sometimes it betokens a subsidence of disease. But, usually, as the part grows tense, the morbid process is further increased ; and, unless speedy relief arrive, suppuration occurs. This is asthenic. The pus is thin and ichorous ; the inflammatory process is not accompanied by plastic results, but pus forms rapidly and extensively in all directions. The areolar tissue is broken up and sloughs ; skin is undermined, and sloughs too. The system sympathises greatly. At first, inflammatory fever exists ; often intense. But, on the occurrence of destructive and diffuse suppuration, a change is made to the form of constitutional irritation ; of a still more alarming character ; probably first shewing the type of irritative fever ; then that of hectic ; ultimately that of prostration and collapse.

But the disorder and its effects are by no means limited to the textures primarily involved. Suppose the case to be both intense and neglected. The inflammatory process spreads, by contiguity as well as continuity ; and that rapidly. Fascia is involved, and subfascial areolar tissue. The tension which results from this is greater and more serious than from merely subcutaneous change ; and the disease is proportionally aggravated. Intermuscular tissue is implicated, and muscles are detached by its disruption ; periosteum inflames, and suppuration—still diffuse—takes place beneath it ; bone inflames and dies ; joints are opened into, inflame, and suppurate. Diffuse suppuration, and sloughing, having at length more or less involved almost every texture of the limb, the suffering frame may demand amputation to save life ; or death may ensue, ere ever an opportunity for operation occur. Such fatal issues are less frequent than they were wont to be, more especially since the free use of iron in the system has been combined with early application of steel to the part ; but stiff joints, necrosed or carious bones, withered limbs, and wasted frames, are still no uncommon results of ill-treated phlegmonous erysipelas.

The constitutional symptoms which may attend on this grave malady

are of three kinds. 1. Of a bilious character, as in most examples of the simple form ; preceding and ushering in the local disorder. 2. Inflammatory fever, during the rise and progress of the inflammatory process. 3. Constitutional irritation ; suppuration having formed, and, being diffuse, advancing rapidly in its devastating progress.

The causes are similar to those of the simple form. And in but few cases will sinister atmospheric influence be found wanting.

Treatment.—This, in the first instance, must be mainly constitutional, as in the simple form. Emetic, purge, antiphlogistic regimen. Were our object simply to overcome an intense inflammatory process, hastening on to dire results, we should bleed always. But we know that, in most cases, the asthenic stage is both early and serious—more especially when the disease is of an epidemic character ; and that, in all cases, if the process be not arrested in its very rise, diffuse suppuration is inevitable, and certainly followed by constitutional symptoms tending to the lowest type. Only at the very commencement of the case, then—in patients previously robust, and when the symptoms hitherto have indicated somewhat at least of the sthenic character—is general bleeding advisable. And even in those cases in which it is expedient, it must be practised with a cautious economy of the “liquid living flesh ;” for, as in compound fracture and other severe injuries followed by inflammatory disease, a long day of trial to the system, by debilitating causes, may be fast and surely impending. In the great majority of cases, it is expedient to give iron internally—early and freely.

The affected part is placed at rest, elevated, and with its muscles relaxed. At first, the most suitable application is hot fomentation ; and under this the inflammatory process may resolve. More commonly, however, it advances as already explained. The skin is tense, and the subcutaneous tissue is largely occupied with inflammatory product, about to become pus. This is the crisis for action ; a period both early and brief. The inflammatory product must be permitted to escape ; and loss of blood, considerable and direct, is necessary to arrest the advancing process. Punctures evacuate serum readily enough ; and the loss of blood which they occasion is sufficient to allay an inflammatory process of no great intensity. They are, consequently, very suitable in simple erysipelas ; but, for the phlegmonous form, they are altogether insufficient. Here punctures are superseded by incisions ; the lancet by the scalpel or bistoury. Through the incision the morbid accumulation in the tissues drains away ; while blood is drawn rapidly, and in sufficient quantity to arrest the local disease. And the inflammatory product, comparatively slight, which does continue for a time, has no opportunity to lodge ; but at once finds a ready access to escape.

This is the true time for incision. Saving disruption and sloughing of subcutaneous tissue, danger to skin, and serious disorder of system ; while the system is yet comparatively recent, and just in the act, as it were, of surmounting its suppurative crisis ; when the part is tense, red, shining, painful, throbbing, and feels like brawn. At a subsequent period, when suppuration has occurred, and diffuse purulent formation begun, incision is demanded ; with equal, or even greater urgency. But its object is wholly different. Too late to save tissue, and prevent

disaster ; in time only to mitigate, and perhaps limit, destruction already done. The knife, when used at the proper time, need not go deeper than the subcutaneous areolar tissue ; the process and its results having, as yet, extended no further. But, when used at a later period—too late to prevent mischief, and only in time to limit—it must generally perforate the subjacent fascia as well. In fact, it must reach all the occupied textures ; otherwise it might almost as well be let alone.

The treatment of phlegmonous erysipelas by incision may be said to be as old as the surgery of the 16th century, according to Prospero Alpini ; or it may be taken even as far back as Oribasius, A. D. 350. But its true introduction into practice is comparatively recent ; by the exertions of Mr. Copland Hutchison and others. It seems a severe remedy ; and doubtless so it is. But it looks more cruel than it really is. The wound appears both wide and deep at the moment of infliction ; but, in a few days, sometimes after but a few hours, subsidence of the swelling may have reduced it to a comparative scratch. And, besides, even though it were altogether as severe as it seems, no other proceeding will prove equally efficacious—in the advanced form of the disease ; and “*ad extremos morbos, extrema remedia.*” There can be hardly any question as to the propriety of free incision, after suppuration has occurred ; for there is no other means of sparing both part and system. Some are not fully persuaded of the justice and expediency of the practice, at the earlier period ; when the textures are only occupied by fibrinous serum, and when the inflammatory process has not reached its crisis. But we think that due consideration of the indications which such treatment comprises, and of the paramount importance of fulfilling such indications, is not unlikely to reconcile all sceptics to the seeming cruelty.

At one time, also, it was matter of dispute, among those who favoured the practice of incision, whether the wounds should be long or short. Whether the knife should be entered at the upper margin of the affected part, and carried down continuously throughout its whole extent, however great that may be (Lawrence). Or whether it should be applied only to those parts most implicated, where tension and pain are greatest, and diffuse suppuration most imminent. Seldom, if ever, is the whole part equally affected. Some points of the surface—perhaps the greater number—may shew only the characters of simple erysipelas, or little more ; while in others the phlegmonous signs are in active progress. By the latter only are incisions demanded. Consequently, we find that common sense and common practice have decided in favour of the “short cut” system ; and no longer, as has been well observed by Professor Cooper, are yard-measures required for ascertaining the extent of incisions in this disease. To enter a knife over the great trochanter, and withdraw it only when it has reached the knee, or not until even the outer ankle has been approached—as has been done—is to inflict a very serious injury. Much loss of blood, shock to the system, and protracted suppuration must follow. And this triumvirate, becoming associated with the exhausting effects of the natural progress of the disease, is not unlikely to overpower the system. A few small wounds, implicating only those portions of the texture where their presence is essential, are not only much less serious as an additional injury, but more effectual as a remedy.

The hemorrhage is direct and copious ; and is permitted to continue, until enough shall have flowed for satisfactory evacuation of the part. And, as formerly stated, in many cases the loss is carried a step further ; so as, at the same time, to afford a sedative result upon the system. Should the flow threaten to prove excessive, the part is elevated, and pressure temporarily applied, on the bleeding point or points, either by the finger, or by lint and bandage. It is very seldom that any vessel is wounded of sufficient size, or activity, to require a ligature. In some cases, when we have hazardous local change, with much impairment of general power, we are constrained to incise, and yet very loath to shed blood. In such circumstances, the wound will be as limited as possible, in both extent and depth ; and temporary pressure, with elevation of the part, will be had recourse to, almost immediately after the incising.

After bleeding has ceased, pressure—if employed—is withdrawn ; fomentation is resumed ; and during the intervals of fomentation, a light warm poultice is applied. The wound itself suppurates ; and, not unfrequently, a thin ash-coloured slough coats its margins. But the surrounding areolar tissue retains its integrity ; its abnormal liquid contents gradually exude ; swelling falls rapidly ; redness, pain, and tension all disappear. This resolute process will be found far advanced, in the course of two or three days ; and then both fomentation and poultice, but especially the latter, are to be discontinued. To employ them longer, would be to render certain the occurrence of those untoward relaxing and suppurative results, formerly stated. Fomentation is altogether laid aside ; and, instead of poultice to the whole surface, tepid water-dressing is applied merely to the wound or wounds ; changed as often as the discharge—at first usually profuse—renders necessary, on the score of cleanliness.

To the general surface, early support by uniform bandaging is expedient ; for like reasons as in the simple form, but more urgently demanded. At first, let the application be especially gentle ; otherwise the stimulus may reinduce the inflammatory process. And in those neglected cases in which suppuration has occurred, areolar tissue has sloughed, and skin has been to some extent undermined, caution in bandaging is most necessary throughout ; otherwise injury may be done to vessels more or less isolated by the destruction which has raged in the common textures around. At the same time that local support becomes expedient, so does support of the system.

The wounds, on subsidence of the general swelling, shrink greatly in their dimensions ; and as both part and system recover tone, discharge is diminished, and healthy granulation sets in. During separation of the superficial sloughs, water-dressing is applied. After separation, this is more or less medicated ; as the character of the granulations may seem to require. Not unfrequently, there is a tendency to exuberance of granulation ; delaying the cure, and producing an unseemly bulging cicatrix, when that is at length obtained. This is best obviated by the early adoption, and due maintenance, of well-arranged pressure.

Erysipelas has been thought contagious ; and more especially the phlegmonous form. On this subject, however, opinion is found to vary. And, during the unsettled state of the theoretical question, it is well to

keep on the safe side in practice ; by treating the disease, especially in hospital, with every precaution against communication.

Not unfrequently, it is complicated with other maladies ; also of a serious nature. Phlebitis and angeioleucitis own the same predisposing and exciting causes ; the predisposing being constitutional disorder of a gastric character, sinister atmospheric influence, or both ; the exciting—wounds, and other mechanical injuries, more especially when treated unskilfully.

Subcutaneous Erysipelas, or "White Rose."

The peculiarities of this form are :—the subcutaneous areolar tissue is the primary seat of the inflammatory process, and often the skin remains throughout entirely unaffected ; the effusion is serous, the process tending to remain in the first stage ; there is no great tendency to tension ; heat and smarting may be considerable, with tenderness to the touch, and a considerable portion of the surface may be involved ; yet the sympathetic fever is usually slight and manageable under very simple means. The surface is pale, though hot, and pits on pressure. The most ordinary site is the forehead. The attack may follow a blow or other injury, or occur spontaneously. Its natural progress is towards a favourable issue ; the swelling, heat, and pain lessening after a day or two ; slight feverishness proportionally declining ; and, within a week or less, both part and system shaking themselves altogether free of the disorder, restoration is complete.

Treatment is simple. Fomentation for a day or two ; rest ; gentle aperients ; cautious diet ; and the sustained internal use of iron.

Varieties of Erysipelas.

Œdematous Erysipelas.—This implies a low grade of the inflammatory process, in a weak system, mainly involving the subcutaneous areolar tissue. Swelling is great, but gradual ; soft ; and pitting, deeply and durably, on pressure. There is no tension, and little heat or pain ; itching, rather, is complained of, and the redness is of a pale hue. The extremities, especially the lower, are the parts most frequently affected. Constitutional symptoms are but slight. There is obvious derangement of health ; more of the asthenic than of the sthenic character ; yet scarcely referrible to any peculiar type.

Treatment.—Punctures are advisable ; but they need be few in number. Their main use is to drain off the serum. For a day, or so, fomentation is employed ; and then uniform bandaging is had recourse to—at an earlier period, and more perseveringly maintained, than in any other form of erysipelas. There is little risk of reinducing the inflammatory process ; and stimulation of absorption is the paramount indication. At the same time, diuretics will probably be expedient ; and iron is freely given from the first. General disorder of secretion may require alteratives. Withal, a tonic system of treatment is to be maintained ; and sometimes it requires to be rather actively pursued.

Bilious Erysipelas.—This term is applied to those cases of Erysipelas,

in which the symptoms of biliary derangement not only precede local change, in a marked form; but are, throughout the whole progress of the case, of a very prominent character. Either simple or phlegmonous erysipelas may be so characterized; but the former by far the more frequently. In truth, the local disease is usually slight; seldom reaching suppuration; and the constitutional symptoms also partake in but a slight degree of the inflammatory type. The more prominent general symptoms are;—headache, nausea, bilious vomiting, pain or weight at the epigastrium, thirst, loathing of food, eyes and face suffused, general hue yellow, sclerotics especially discoloured, foul dry tongue, and a bitter taste in the mouth, bowels constipated, urine scanty, and depositing a copious turbid sediment. Locally, the ordinary signs of the inflammatory process are but slight; and redness is almost merged in the prevailing yellow discoloration of the integument.

Treatment will be mainly of the constitutional kind; emetics, purgatives, alteratives, diuretics, and diaphoretics, as circumstances require; and on these the practitioner is mainly to rely, for cure of the local as well as of the general symptoms. Iron will be given sparingly, and secondarily, if at all. Treatment of the part is but a secondary matter, and is gentle, in proportion to the disease for which it is demanded; fomentation, rest, bandaging.

Erratic Erysipelas.—The peculiarity of this form is its tendency to shift from one part to another. Not extending merely, and occupying a larger space, as simple erysipelas does; nor leaving one part suddenly, to reappear at another, somewhat distant—as any form of the disease may do. But leaving one part for another; and yet maintaining the extension continuous and unbroken. The inflammatory process is invariably slight; often little more than a mere erythema. Its occurrence is almost uniformly indicative of a feeble and impaired system. The constitutional symptoms are always antecedent, as well as attendant; of the asthenic kind; and if not actually typhoid, tending manifestly to that character.

Treatment, accordingly, has little to do with the affected part. Fomentation and rest suffice for that. And if the spreading be in an unfavourable direction, as towards the face or scalp, it may be diverted into another course, by the use of nitrate of silver as a limiting agent. Or a blister may be applied—to concentrate the inflammatory process. The system mainly occupies our regard. Alteratives, tonics, stimuli, are given as required. When sinking has fairly threatened, turpentine, given by both mouth and rectum, will be found an excellent remedy, in addition to the ordinary means of support.

Periodic Erysipelas.—By this term is understood a form of the disease, characterized by frequency, and sometimes by accuracy, of return; either reverting always to the same part, or selecting a variety of parts for its seizure. Sometimes the season of the year, sometimes the occurrence of menstrual function, seems to determine the period of return. The case is usually slight.

During the attack local treatment need be but gentle. Our object is not to cut short the disease, but only to smooth its course; and the safety of texture demands no energy of interference. Repellents are especially reprehensible. Iron internally is specially valuable, availing

to render the cure both speedy and permanent. With the latter object in view, it is often advisable to continue its use for some time after all trace of the attack has disappeared.

It is during the intervals of attack, and when invasion is expected—either from return of the ordinary time, or the appearance of premonitory symptoms—that treatment will prove most useful; directed towards removing that abnormal state of system, whether constant or periodic, on which the erysipelatous affection mainly depends.

Hospital Erysipelas.—This term is often applied to the disease, in all its forms, as occurring in hospital practice; the patient not being admitted while labouring under the affection; but having been seized by it, while resident within the institution on account of other ailments. The phlegmonous form is most common under such circumstances. And if the cases prove numerous, either the disease will be found at the same time prevalent out of doors—by reason of untoward atmospheric influence; or some serious fault will be found in the hospital management, as regards ventilation, dressing of sores, and bestowal and arrangement of patients. The chief peculiarity of hospital erysipelas is that an especially asthenic type prevails; and that, consequently, as a general practice, energetic, spoliative, and depressing antiphlogistics are not advisable in the treatment.

Our attention is to be chiefly directed towards prophylaxis. The number of patients, in one ward, should be few; and those with foul running sores should be carefully segregated. Sores should be dressed lightly, and simply; avoiding all stimulating, acrid applications, lest undue excitement follow, and the spreading or erysipelatous character supervene. No sponges should be permitted to appear within the wards; and every possible means should be taken, to avoid community of dressing, and contamination of sores. Dressing is to be renewed, as often as cleanliness demands. Not unnecessarily; lest the sore resent, and inflame. Not too seldom; otherwise pus accumulates and putrefies; not only irritating the sore and its vicinity, but polluting the whole atmosphere of the ward, and injuring all its occupants. Ventilation, and general cleanliness of the apartments are most essential. And, as formerly stated, it is well to use all precautions, as if the disease were undoubtedly contagious.

HOSPITAL GANGRENE OR HOSPITAL SORE.

This was, at one time, a scourge of hospitals, both in civil and in military practice; especially in the latter. But since both the treatment of sores and the management of hospitals have much improved of late, it is of comparatively rare occurrence. And, when it does appear, it seldom evinces those formidable and intractable characters, which formerly used to carry devastation and death.

It seems to have been known and described by the old writers, as *Ætius*, *Paulus*, and *Avicenna*; but was not noticed, prominently and distinctly, till the end of the last century, and beginning of the present. Then, from the crowding of wounded men in hot, dirty, and confined

apartments, perhaps after long and rough carriage, with bad food, mental depression, and insufficient attention to dressing and cleanliness—foul degeneration of sores became not uncommon. And Hospital gangrene came forth in all its virulence ; as the graphic pages of Hennen, Blackadder, and Boggie, sufficiently testify.

At present it makes its appearance, occasionally, in the Surgical Hospital of this city ; in a slight form. In truth, we believe that few Hospitals grow *old* without contracting a tendency to the generation of this trouble, more or less ; and that no Hospital, unless thoroughly ventilated at all times, and thoroughly cleaned and purified very frequently, can ever expect to remain altogether free from it, more particularly at unhealthy seasons of the year.

The disease is an example of Sloughing-phagedæna. It may be produced by direct contact ; or, more indirectly, by infection. Or it may occur independently of either ; from crowding, evil dressing, bad ventilation, and otherwise noxious atmospheric influence. Mercurialism is also favourable to its accession. It may attack a wound already existing, or appear in a part previously sound and whole.

On an unbroken surface, the first appearance is usually either a pustule or vesicle ; small, dark, and accompanied with sharp stinging pain. On giving way of the cuticle, a slough is formed, and this continues to extend in both surface and depth. After a time, the slough begins to separate ; but without arrest of destruction in the part ; this being continued by acute phagedæna, often with greater and more unremitting pain than before. Then sloughing appears. And so the work of local death advances ; invariably accompanied with profuse, foetid, and thin discharge. Sometimes the progress is so rapid, as to cover a large space within a few hours ; in other cases, the advance is reckoned more conveniently by days. The ulcerous cavity is generally of a circular form ; as if scooped out by an instrument. The edges are jagged, everted, and well defined ; often studded with red points of a peculiar appearance. The lymphatic glands are apt to become affected, at an early period ; they enlarge, suppurate, and open ; and the ulcer is prone to assume the same condition as the original sore. The surrounding parts are swollen, red, tense, painful, and of a dark livid hue. And this inflammatory process is apt not to remain limited, as a mere antecedent to local death ; but to spread, adding the serious complication of erysipelas to the original malady. Thus hospital-erysipelas and hospital-sore may be found to co-exist.

When a wound is attacked—as is most frequently the mode of accession—pain becomes very acute—the patient complaining as if stung there by an insect. Discharge is diminished ; or may be, for a time, altogether arrested. Then the granulating surface rapidly changes, assuming a dirty white colour ; and sometimes becoming spongily elevated and crepitant, by air, the product of putrescence. The surrounding skin swells, and is of a purplish hue. Slough forms, either in one continuous mass, or in detached portions. The dead matter begins to separate, but not by a healthy process ; the edges harden, become everted, remain of a dirty white appearance, and pour out much foetid discharge—very different from the healthy pus which escaped but a few

hours before : and now the characteristic fluidity becomes fully established. Sometimes the body of the sore has not the grey or whitish colour, which usually obtains, but is dark from the beginning ; the sloughing parts being infiltrated and mixed up with putrid extravasation. The degeneration generally commences at the edges, but rapidly invests the whole ; and the progress of the malady is also chiefly marginal.

The constitutional symptoms, in whatever way the local affection may have begun, are invariably formidable—constitutional irritation, typhus fever, and tendency to collapse. As in erysipelas, they sometimes precede and usher in the local change ; sometimes they are only consecutive and attendant. When antecedent, they are always aggravated by the occurrence and extension of the local disorder ; an event not invariable in erysipelas. In some very few cases, when the patient was just before robust and in rude health, and has suffered by direct contagion, the introductory constitutional symptoms may be of the inflammatory type ; but, even then, these will be very transient, and soon become merged in irritation. More frequently, the commencement is with irritative fever ; this glides into the confirmed typhus, and sinking follows.

Along with corporeal depression comes mental despondency—"The bravest soldier betrayed a symptom which, in those of less strength of mind, formed a striking feature in every stage of the disease ; namely, the greatest imaginable impatience of pain, and depression of spirits. Those who had borne amputation without a groan, shrunk at the washing of their sores, and shuddered at the sight of a dead comrade, or even on hearing the report of his death ; instantly predicting their own dissolution, and sinking into sullen despair."*

No texture is proof against the ravages of this disease. The arterial resists longest, but in the end gives way ; and hemorrhage ensues. For there is not, as in ordinary gangrene, more especially when of the chronic kind, the solidifying of arterial contents, with occlusion of the canal up to the nearest collateral branch. Death of the part being rapid, the slough is peculiarly humid and soft. Circulation, though feeble, goes on till sphacelus is complete ; and, besides, it is probable that the blood's power of coagulation has been much impaired, as happens in other examples of poisoning of the system.

This bleeding may be favourable, as formerly stated, if only to such an extent as to affect the part ; resolving the inflammatory process which precedes and leads to the local death. More frequently, it is profuse and prejudicial ; increasing the prostration, and hastening the fatal issue. "The third and last stage was now fast approaching. The surface of the sore was constantly covered with a bloody oozing ; and, on lifting up the edge of the flabby slough, the probe was tinged with dark-coloured grumous blood, with which also its track became immediately filled. Repeated and copious venous bleedings now came on, which rapidly sank the patient ; the sloughs, whether falling off spontaneously, or detached by art, were quickly succeeded by others, and discovered on their removal small thickly-studded specks of arterial blood. At length an artery sprung, which, in the attempt to secure it,

* Hennen's Military Surgery. p. 219.

most probably burst under the ligature ; the tourniquet or other pressure was now applied, but in vain ; for while it checked the bleeding, it accelerated the death of the limb, which became frightfully swelled and horribly fetid. Incessant retchings soon came on, and with coma, involuntary stools and hiccup, closed the scene." *

Or, instead of advancing to a fatal issue, recovery may take place. In this country, and at the present day, this is the general rule, under proper management ; death, and even much local destruction, forming the exception. Constitutional disorder gradually abates ; pain diminishes ; and the inflammatory process producing gangrene is succeeded by that which is the herald of arrest. Sloughs separate ; and are neither renewed, nor supplanted by phagedæna. Discharge becomes less copious, thin, and fetid ; more purulent, and laudable. Granulation and repair are established. But such amendment is not to be reposed in implicitly. Anxious care is yet requisite ; for relapse is by no means unfrequent.

Treatment.—As in hospital erysipelas, prevention is our chief object ; and is to be obtained by similar means. When the disease has occurred, the treatment is of that kind formerly recommended for sloughing phagedæna in general. Locally, escharotics, efficiently applied, and repeated if necessary, followed by poulticing or water-dressing, until sloughs separate, and healthy granulations appear. Constitutionally, gentle yet effectual unloading of the primæ viæ ; calmatives ; anodynes ; if need be, stimuli. Bleeding, or other powerful antiphlogistic remedies, are never warrantable ; and mercury is to be avoided, as a poison. On arrest of the local disease, the constitutional disorder often voluntarily subsides. The chlorurets of lime or soda correct fœtor.

FURUNCULUS, OR BOIL.

This is a limited inflammatory process, always of the sthenic type, affecting a small portion of skin, which may or may not be connected with a sebaceous or hair follicle. The cutaneous texture becomes enormously thickened, and while some of the results of the rapid cell multiplication die, and form a central core, this is accompanied and surrounded by laudable suppuration. It is not a mere pimple. For that is but suppuration of the interior of an obstructed sebaceous follicle. Nor is the term to be regarded as synonymous with carbuncle. For that consists structurally rather of a congeries of boils, is more extensive originally, liable to spread, and attended both generally and locally by asthenic symptoms throughout ; sometimes, nay frequently, bringing life into serious peril. Whereas, the boil is not only sthenic in itself, but often rather indicative of a robust and plethoric system. At all events, the attendant constitutional disorder partakes, more or less, of the true inflammatory type ; and requires to be treated accordingly.

The affection is most frequent in the young and middle aged ; and in those who, eating freely, are liable to stomachic and hepatic derangements. The most common site is where the skin is thickest, and perhaps most removed from ablution ; on the back, shoulders, hips, back of

* Hennen's Military Surgery, p. 220.

the neck, and thighs. At the same time, the face is no stranger to boils. There, as elsewhere, they seldom occur singly.

The swelling is of a conical shape ; its apex yellow ; its base hard, red, and exquisitely painful. The pus is superficial ; the core is at the base. If left to itself, the boil bursts at the apex ; and the matter escapes by a single aperture. Sometimes this is sufficient to permit a free passage to the core, when loose ; more frequently, it is insufficient for this purpose. On purulent discharge taking place, the pain, heat, and surrounding swelling usually abate. But subsidence is not complete, until slough, as well as matter, has been extruded ; the former, so long as retained, acting the part of a foreign body, and maintaining inflammatory disorder.

The predisposing cause is derangement of the primæ viæ, and consequently of secretion in general. The exciting may be some direct stimulus of the part ; as by a prick, scratch, or evulsion of hair. Not unfrequently, no exciting cause exists ; the predisposing, alone, is sufficient.

Treatment.—During the nascent condition of the inflammatory process, fomentation is used ; with water-dressing, or poultice. In cases of peculiar irritability and suffering, relief may be obtained by free incision, at the outset, so as thoroughly to relieve tension.

On suppuration having occurred, an incision is made in the apex ; sufficient to ensure discharge, not only of the pus, but of the slough also. If an opening already exist, it is dilated ; for the like purpose. The part is kept at rest ; and, after ejection of the core, the granulating wound is dressed in the ordinary way. Constitutional treatment—not the least important—consists of purgatives, followed by alteratives ; to cleanse and rectify the primæ viæ. And somewhat of the antiphlogistic regimen should be enjoined throughout the whole process of cure. To prevent relapse, experience speaks in favour of two very opposite remedies ; alkalies, and mineral acids. The ordinary gastric indications will determine which class of remedies is the more suitable.

ANTHRAX, OR CARBUNCLE.

This is more extensive, and, consisting as it were of a congeries of boils, is altogether more important, than the preceding. The inflammatory process is acute in its seizure and progress, but speedily attended by symptoms indicative of grave constitutional depression, and a tendency to sloughing and destruction of tissue. The affection is not prone to spread rapidly as in phlegmonous erysipelas, and possesses this further difference, that in carbuncle the skin seems to be primarily and chiefly affected. The cutis becomes enormously thickened by the accumulation of inflammatory product among its textures, whereby it is not only expanded in bulk, but becomes brawny to the touch. A section, in the early stage, displays the skin, so altered, studded with a number of pea-like yellow masses, which, towards the centre and surface of the affected portion of skin, are larger and softer ; constituting, when completely confluent, a carbuncular abscess. When the loaded cutis is left to itself,

it suppurates and sloughs ; not in mass, but in detached portions ; and as these separate, apertures are formed on the surface through which unwholesome pus, with debris of structure, is discharged. Secondly, the subcutaneous areolar tissue may be involved, and is then prone to run into sloughing.

At first the part is brightly red, tense, and burning ; with a peculiar sense of tightness in the pain—corresponding to the strain on the cutis by infarction ; afterwards the colour becomes more dusky, and the feeling rather of sponginess than of tension—except at the margins, where tension still remains. Pressure is intolerable.

The swelling is flat, when compared with that of furunculus or of an ordinary abscess ; and instead of central pointing, enlargement and extension are towards the circumference.

Carbuncle is usually found in the same situations as furunculus ; but, unlike it, is generally solitary. It may vary in size, from a prune to a soup plate. Progress is slow when compared with that of erysipelas ;

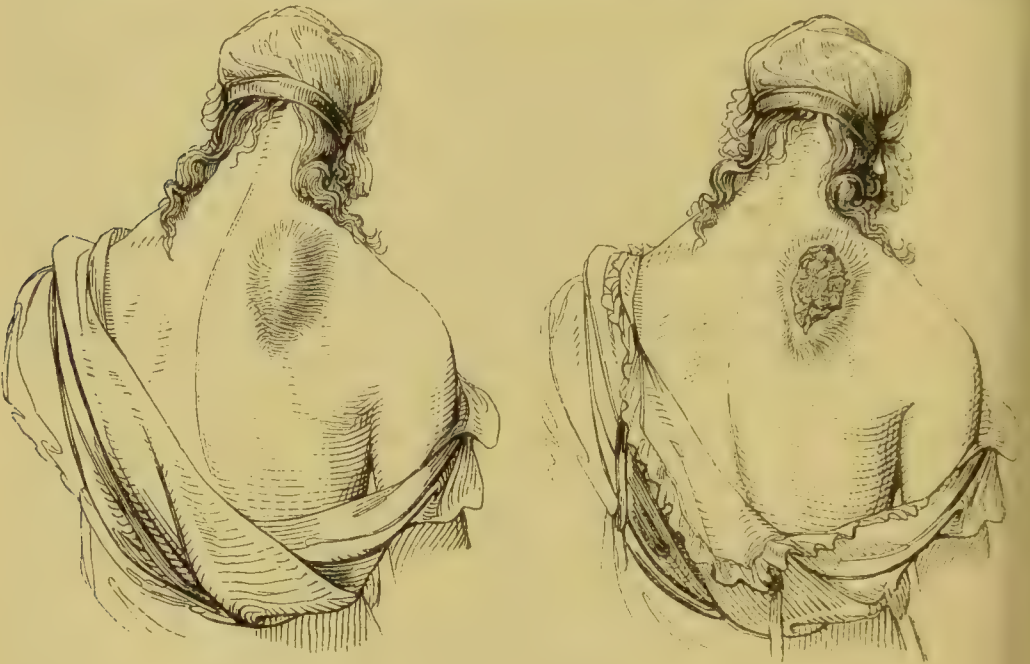


Fig. 103.

and ordinarily limited to the surface. But, sometimes, when suitable treatment has been omitted, the deeper parts are also involved ; so as to expose cavities, canals, and bones.

The disease most commonly occurs in patients of middle age, or further advanced in life ; and especially in those who have indulged, freely and habitually, in the pleasures of the table. It is not contagious. Not unfrequently the urine, on being tested, is found saccharine. The constitutional symptoms invariably precede. They are usually asthenic throughout ; at first of a simply febrile and bilious character ; but as the inflammatory tension and sloughing increase, tending rapidly towards prostration—more especially in the old and feeble—with hiccup, cadaverous countenance, small pulse, delirium and coma.

Fig. 103. A common seat of carbuncle shewn ; in the one case occult ; in the other open, exposing the sloughing tissue.

In the milder cases, sloughing may be prevented by suitable treatment. When this has not been employed early enough, the sloughs separate after a time and are discharged; healing advances more or less rapidly, with marked contraction; the constitutional symptoms proportionally subside; and the patient recovers, with a puckered cicatrix, shewing more or less loss of substance in the cutaneous and even in the subcutaneous tissues.

Treatment.—This consists of free and early incision usually of the crucial form, throughout the whole extent of the diseased mass, making sure that the knife penetrates, at each extremity of the wound, not only the actually carbunculous part, but a margin of sound skin too; so as certainly to relieve tension. If done early, this has as its aim the prevention of sloughing altogether, or at least its reduction to a minimum. Pain and the sense of tightness are immediately relieved; and the disease, arrested in its higher range, begins to resolve by suppuration. Should one crucial incision not prove sufficient, as is the case in large carbuncles, others should be made, where the tension continues and the disease is unchecked. Poultice is applied for a few days; then water-dressing.

When sloughing has occurred to some extent, as shewn by the boggy fenestrated state of the skin, the treatment is still the same—incision and poultice. But the cure will not be so rapid or complete; and the cicatrix, tardily come, will shew loss of substance in all the textures affected.

In the more advanced and severe cases, when sloughing is great, and the constitutional symptoms formidable—more especially in the aged—something more is required. The bistoury should be followed by the potassa fusa, which is thrust freely into the diseased mass. By it, the dying parts are at once converted into a dead eschar; healthy separation is accelerated; and injury of the system, from absorption of the deleterious products of humid putrescence, is almost at once arrested. And, further to ensure fulfilment of the last indication, the slough, as it loosens, is to be carefully removed; by knife or scissors. The practice seems severe; but no other will prove, in all respects, successful. And the more advanced the case, the greater the necessity for its adoption. Less pain is occasioned than might be supposed; the greater part of the cauterized tissues being already in a gangrenous state.

Constitutional treatment is never thoroughly antiphlogistic. At the commencement, evacuants are often necessary. For the stomach and bowels—an emetic and purgation. For the liver—podophyllin. Then, occasional alteratives; perhaps, the hydrargyrum c. cretâ. The diet of the patient should consist of nutritious but non-stimulant food; bread and milk, beef-tea, and such like, until the local inflammatory symptoms begin to abate. Tonics and stimuli are not required at the first; but when the inflammatory symptoms are past, and a typhoid condition is imminent or actually present, bark, wine, ammonia, brandy, turpentine enemata, must be given, according to the features and exigencies of the case. So long as the power of swallowing remains, remedies are to be perseveringly administered; for, provided suitable local treatment have been practised, patients often rally completely, even though previously *in extremis*.

ENTOZOA WHICH AFFECT THE INTEGUMENT.

In the West Indies, a small insect, the *Chigoe* (*Pulex penetrans*), lodges in the subcutaneous tissues of the foot, and breeds there, causing great itching of the part ; and forming a small cyst, which enlarges into a swelling about the size of a pea. Treatment consists in extraction of the cyst, entire ; otherwise, troublesome suppuration is apt to ensue. To ensure thorough extirpation, the use of an escharotic may sometimes be expedient.

In China, India, Africa, and other hot climates, the *Guinea worm* (*Dracunculus*, or *Filaria medinensis*) troubles mankind ; lodging, like the other, in the subcutaneous tissues ; having probably penetrated the skin when small. As it grows, a painful and itchy swelling forms ; sometimes corded ; sometimes like a varicose vein ; sometimes more diffuse, like an abscess. Ultimately suppuration takes place, the skin gives way, the animal is partially exposed, and a painful festering sore remains. While the creature is merely enlarging in bulk, the disturbance it occasions may be but slight ; but when the period of reproduction arrives, it seeks to perforate the skin, and causes furunculous disorder. If injured then, a milky fluid is found to exude from it, which, under the microscope, shews myriads of young worms. So long as the animal retains its lodging, the inflammatory process continues ; and may become serious by intensity and diffusion. To prevent this, and obtain healing, it is necessary to extract the worm ; not at once, but gradually. A portion, having been exposed, is attached to a small roll of plaster, or other suitable substance ; and by gradually winding it on this roller, day by day, the creature is removed entire. An attempt at immediate extrusion is sure to fail ; the worm breaking short, growing again, and reproducing the inflammatory evils.

TUMOURS OF THE INTEGUMENT.

Warts are of two great classes ; Simple and Malignant. The simple are considered to be prolongations of the papillæ, changed somewhat in structure as well as hypertrophied ; sometimes flat and diffused ; sometimes prominent, and cylindrical in form. When situate on the outer part of the body, the investing cuticle is thick, rough, and dry. On the inner part of the body, and more especially when opposing surfaces are affected, as within the prepuce and vulva, and upon the thighs and nates, the cuticle is thin and delicate ; and a sero-purulent discharge is exhaled.

These formations may again be divided into Common and Venereal. The former of spontaneous origin, unconnected with any apparent cause ; usually dry, very vascular, sensitive, sessile, and discrete. The latter dependent on the pre-existence of some form of venereal, or, it may be, simple source of irritation ; humid, usually aggregate ; sometimes attaining to an enormous size, and situated on or in the neighbourhood of the organs of generation.

The dry variety can best be removed by scissors, or nitric acid. In

the case of the venereal warts, when small, little vascular, and occurring singly, or scattered over the surface, their destruction may be effected by careful attention to cleanliness, keeping the parts dry, and by the application of a minor caustic—such as sulphate of copper, nitrate of silver, aromatic vinegar, a solution of corrosive sublimate; or by the use of a stimulant astringent, such as dessicated sulphate of iron, or powder of Savine. Sometimes the repeated dusting of the surface with oxide of zinc may suffice. If the form of the wart be in aggregate masses, a more summary process of removal may be employed, by knife, scissors, or ligature. The large venereal warts bleed copiously when cut; but the hemorrhage can easily be checked by compresses soaked in the solution of the perchloride of iron. By some caustics are preferred. Of these, fluoric acid, monohydrated sulphuric acid, a magma of corrosive sublimate, or a paste of the chloride of zinc, may be used.



Fig. 104.



Fig. 105.

Warty formations are frequently of a malignant kind in the aged; and are most commonly situated on the face, as a commencement of Epithelioma. The wart is of an angry and irritable character; and soon degenerates into cancerous ulceration. The remedy is removal by excision of the wart, along with the whole thickness of the skin from which it is developed; and this should be effected at as early a period as possible.

The skin is liable to simple *Hypertrophy*; extending over a considerable surface. The texture becomes rough and open; the rugae and markings are large and broad; and the sebaceous follicles are unusually distinct. Pressure, and the use of iodine, suffice at least to arrest increase of growth; and considerable diminution may even be effected. Should the bulk be great, and prove troublesome, the changed texture may be removed by incision; either wholly or in part. Being a simple hypertrophy, and not a true tumour, partial removal does not entail

Fig. 104. Warts on the penis.

Fig. 105. The summit of a papilla from an epidermic growth, the result of a burn. Each papilla, consisted externally of numerous epidermic scales distinctly nucleated, compressed together. Internally it was composed of fibrous vascular tissue.—BENNETT.

reproduction. Ligature of the main artery of the limb has also been resorted to in such cases.

Hypertrophy of the skin, however, is more frequently associated with a similar condition of the subcutaneous adipose and connective tissues ; often termed *Lipoma*. At the same time, there is much discoloration of the skin by constant passive congestion. To this morbid condition the integument of the face, especially of the nose and cheeks, is subject. The cure is, removal by careful dissection ; the general health being at the same time attended to. Usually there is great necessity for alteratives, and regulation of diet.

The nævus and erectile tumour, Epithelioma and Scirrhus, are often met with in the integument ; amenable to the ordinary rules of treatment. And the encysted tumours, as we have already seen, are usually situated immediately beneath the surface.

CHAPTER XII.

AFFECTIONS OF THE SEROUS AND MUCOUS MEMBRANES.

THESE belong rather to the department of the physician, than to that of the surgeon; still it is necessary to notice them shortly here, surgery being not unacquainted with both their immediate and their remote consequences.

The Inflammatory Process affecting Serous Membrane.

Serous membranes are especially liable to assume the inflammatory process; with or without a direct exciting cause. The process varies, according to circumstances, in its kind and degree; and, as it varies, so do the results. Under all circumstances, it is apt to spread widely and rapidly, by continuity; and in all acute cases the constitutional symptoms are severe. Usually, also, much local pain attends.

At first, the natural secretion may be diminished, or arrested; afterwards it becomes more profuse, containing fibrin, and also a greater proportion of albumen than is usual. The balance between product and absorption may, in the outset, scarcely be overborne; but very soon accumulation is begun, and advances; constituting dropsy. Such accumulating fluid departs more and more from the healthy standard; ultimately becoming puriform, and often containing more or less of true purulent admixture. But the membrane itself undergoes important change; at first injected and spongy, afterwards enlarged and roughened; and often coated, more or less thickly, with plastic product which becomes organized, and variously modified in structure. In chronic disease, of a mild type, simple thickening and opacity of the membrane take place, accompanied with more or less accumulation of serosity; as is frequently observed in the arachnoid.

By the serous accumulation, dropsy is produced; and injurious consequences may ensue, on account of the mere bulk of the effusion; independently of other circumstances attendant on the morbid process. By the plastic formation, opposing surfaces may be united and incorporated; sometimes producing harm, as when the heart adheres to its pericardium, or the lung to the pleura costalis; sometimes, however, productive of much benefit, as when the bowels so cohere on their serous surfaces as to prevent purulent irruption, or faecal extravasation, into the general peritoneal cavity. It is seldom that acute dropsical accumulation occurs, without plastic change in the membrane; it is not uncommon, however, for agglutination of opposite serous surfaces to take place, even extensively, with but little accumulation of serum.

While the serous tissue is especially liable to produce abnormal product, both serous and plastic, and while also the formation of pus is not uncommon in connection with altered membrane and dropsical accumulation, the higher results of the inflammatory process—ulceration and gangrene—are fortunately rare. The latter is seldom observed unless when extending on a large scale, and in an acute form, from other parts; against the former, serous membranes are specially endowed, like all fibrous tissues.

The connection of diseases of the serous membranes with surgical practice is very apparent, in relation to wounds and other injuries of the head, chest, and abdomen, and in the management of hydrothorax, empyema, and ascites. The treatment of acute disease is conducted on ordinary antiphlogistic principles.

The Inflammatory Process affecting Mucous Membrane.

The mucous is liable to inflammatory change, perhaps still more frequently than the serous membrane. The results are more various.

Simply inflaming, the membrane is congested and swollen; at first dry, afterwards pouring out an increased and vitiated secretion. The submucous areolar tissue is occupied by serous or fibrinous product; and, in the more severe cases, extravasations of blood are sometimes found. The surface of the membrane is altered, becoming rough and spongy; the papillæ are enlarged and prominent; and the follicles are swollen, with diminished orifices. Sometimes the general swelling, by submucous effusion, is very great; and may be productive of the most serious consequences, as in cedema glottidis. The increased secretion soon changes from the simply mucous character; becoming opaque and glutinous, afterwards puriform, and ultimately purulent. In acute and severe cases, such discharge is often of a greenish colour, and may be mixed with blood; as in gonorrhœa. Sometimes the discharge contains much blood, or may even seem entirely sanguineous; as in acute cystitis—where, however, there is often ulceration. Intense exacerbation of the affection may temporarily arrest all discharge.

A spreading inflammatory process, of an erysipelatous character, is not unfrequent; arising, apparently, from the same predisposing and exciting causes as ordinary erysipelas; and, in fact, often associated with that disease. It, too, is liable to be attended with great swelling; and may extend over a large amount of membrane.

Mucous surfaces are not so prone to produce plastic material, or “false membrane,” as the serous are. And yet, in certain parts, it is not uncommon; as in the air passages, especially the larynx and trachea. From the bladder, too, false membrane, even of large extent, has been thrown off; and from the lining of the intestines, similar productions are by no means unfrequent. Such formation, however, is separated from the membrane by viscid mucous secretion, and is seldom vascularized, or incorporated with the original tissue. It is sometimes patchy and thin, as in Diphtherite; sometimes thick and tubular, as in croup, and tubular bronchitis. The serious consequences of such a product, in any part of the air passages, can be readily understood.

Suppuration, it has been already stated, is a common result, while the membrane is yet entire ; as in gonorrhœa. But frequently the membrane does give way. Pustules form ; often in the follicles ; as similar formations occur in the analogous texture of the skin. The pustule breaks, and ulceration follows, with purulent discharge ; the raw surface consisting of many isolated points, or of one continuous breach made by pustular coalition. Such changes are most frequently observed in the intestines, and in the mouth and fauces ; in the latter situation they are termed Aphthae. Ulceration, however, is not always of pustular origin. It may originate from intense inflammatory change, as in other textures ; spreading both in depth and surface ; often accompanied with great constitutional disturbance, as in dysentery ; and even when healed, producing serious consequences, by contraction or other alteration of the affected part—as in the bowel or urethra, and in the gullet or windpipe. Or changes may take place exterior to the part, requiring subsequent surgical operation ; as in the case of fistula in ano, induced by ulcer of the rectum. Or the result may be immediately fatal ; as in perforating ulcer of the stomach or intestine. In some cases, however, comparative proneness to ulceration, when contrasted with the serous membrane, is no disadvantage ; as in the evacuation of an abscess which has been baulked in the natural effort of reaching the integumental surface. In the intestine, and also in the windpipe, ulceration is often the result of tubercular change.

An intense asthenic inflammatory process may terminate in gangrene of the membrane ; as in the worst form of Cynanche, and in some cases of Dysentery. This result, however, though more common than in serous membrane, is still, in reference to other tissues, comparatively rare.

The chronic inflammatory process, affecting the mucous and sub-mucous tissues, often produces serious alterations of structure. The papillæ and follicles undergo enlargement and permanent change ; the membrane is thickened ; and by such thickening, but mainly by sub-mucous product, contraction of the canal occurs. Or ulceration may take place, slowly advancing ; by perforation, endangering life ; or, by contraction in healing, compromising the functions of the canal.

The treatment of inflammatory affections of mucous membrane is conducted according to general antiphlogistic principles. In the simpler forms, in accessible parts, great benefit is derived from light use of the nitrate of silver, as in similar affections of the skin. Fibrinous results may urgently demand surgical interference ; and so may the œdematous ; as in the windpipe. Ulceration, too, as already stated, may lead to operation ; and contraction by mucous and submucous change is the subject of daily manipulation, in the case of stricture of the urethra. Such matters, however, will be more suitably discussed hereafter.

Tumours of Mucous Membrane.

To these the term *Polypus* is applied. They are of various kinds. 1. The Simple Mucous. 2. The Cysto-mucous. 3. The Fibrous or Fibroid. 4. The Medullary. The first two are simple in structure, and

benign in tendency. The third is of doubtful character, and prone to degenerate. The last is most malignant.

1. *The Simple, Benign, Mucous Polypus* differs but little, in appearance, from the original texture in which it is produced; and of which, indeed, it is little else than an out-growth, or hypertrophy. In structure, it is softer and more pulpy; less vascular, only a few sluggish vessels

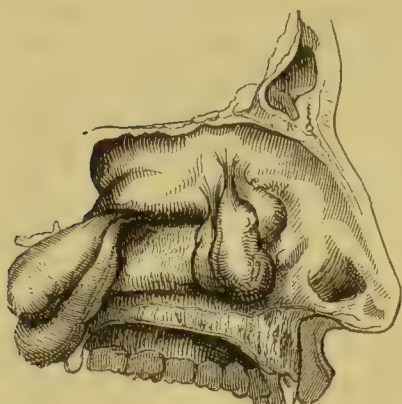


Fig. 106.

being seen coursing on its exterior; of paler hue, and of much less sensibility. The mass is pyriform, attached by a narrow peduncle. They seldom occur singly, but in clusters; the majority, however, being for a time held in the background by one or two large tumours, which fully occupy the space in which they grow. The attachment does not extend to a greater depth than that of the mucous membrane. They are most frequently found in the nasal passages; in the uterus they are common; more rarely they are connected

with other parts of the genito-urinary system; and the respiratory and alimentary canals are not altogether exempt.

Treatment is by evulsion. The tumour is laid firm hold of by forceps, at its narrow neck, as close as possible to the point of attachment; and by a twisting movement, combined with that of gentle pulling, the attachment is torn away, and the part removed. There is no reproduction; but there may be an appearance of it. For some of the small polypi—formerly compressed, and squeezed close to the roots of the larger—now expand and grow apace. The disease is reproduced, doubtless, though not by return of the original tumour; and of this circumstance it is necessary to apprise the patient to prevent disappointment. The hemorrhage that follows is slight; and is easily restrained by pressure. No violence is necessary, in the evulsive effort. It is besides inexpedient; tending to tear away an unnecessary extent of membrane, perhaps with a portion of subjacent bone, and also to augment the hemorrhage.

2. *The Cysto-mucous Polypus* may be original; or the preceding form, by long endurance, may change into this. The structure is not homogeneous; but contains cavities, filled with clear, glairy fluid. The colour is paler; at the fundus, often of a whitish hue, like an oyster. The texture is more dense; especially at the parietes of the cysts, which are sometimes almost cartilaginous. The form, attachment, tendency, and treatment, are the same as in the benign form. This variety seldom occurs but in the nostrils.

3. *The Fibrous Polypus*.—This is fibrous or fibroid in structure; invested by mucous membrane; of a cylindrical or sessile form; and attached by a broad base not only to the mucous membrane and subjacent tissue, but, in the case of the nostrils, also to the periosteum; indeed, it may be connected with the bone itself. Like the preceding varieties, it is the seat of little or no pain, and proves inconvenient chiefly by its

Fig. 106. Simple mucous polypi, seen growing in the nasal passages.

bulk, position, and tendency to bleed. But, while the others seldom if ever degenerate into the medullary or other malignant formation, this is prone to do so. Early removal is therefore expedient. If the neck be unusually narrow, the shape being more pyriform than is its wont, either evulsion or deligation may be employed. But, in the majority of cases, excision is demanded ; it being most expedient that no remnant of the morbid structure should be left behind, lest reproduction ensue. And in order to effect this thorough removal, preliminary incisions, perhaps severe, are requisite in certain situations ; as will afterwards be shewn. This variety of polypus occurs most frequently in the nostrils, and in the uterus ; sometimes in the pharynx, rectum, and vagina.

4. *The Medullary Polypus* may be a degeneration of the fibrous ; or of original formation. Most frequently it is the latter. Occasionally it is associated with the simple form. I have seen the front nares filled with ordinary mucous polypi, while a large malignant tumour hung down into the throat. It follows the usual course ; and, when original, no hope of cure need be entertained. Its most frequent sites are the nares, antrum, pharynx, and œsophagus. In some few cases, when the formation is yet recent and apparently limited, and when it has been of secondary origin, free removal of all suspected as well as of all implicated parts may be warrantable. But, in the great majority of cases, palliation only is within our reach ; and we should attempt no more.

CHAPTER XIII.

AFFECTIONS OF THE PERIOSTEUM AND BONE.

To the inflammatory process occurring in the investing membrane of bone, the term *Periostitis* is applied ; in the substance of the bone itself, that of *Ostitis*. And be it understood that these terms include the whole range of the inflammatory process, from its first and slightest commencement, up to its highest and most destructive result.

Practically, the two diseases may be regarded as always more or less combined. The periosteum cannot be affected to any considerable extent or degree, without the corresponding bone suffering also, and *vice versa*.

According to the issue, various names are applied :—Plastic results may occur, causing *Node* or *Hypertrophy* of bone ; suppuration may take place, causing *Abscess* of bone ; ulceration, causing *Ulcer* ; ulceration of an intractable and peculiar kind, causing *Caries* ; death of bone, causing *Necrosis*.

Periostitis.

This may be the result of direct external injury, as by a wound or blow ; and then its character is usually acute. Or it may originate from internal causes ; and from none more frequently, than from a vitiated state of system induced by the syphilitic taint, or by imprudent and unnecessary mercurialism. Then its progress is usually more chronic. Or internal causes may be combined with external ; the former predisposing while the latter excites. Mercurialism may co-exist, for example, with exposure to untoward atmospheric influence ; and, in such circumstances, the disease may partake of both the chronic and the acute characters.

Sometimes the affection is of secondary invasion ; extending from the bone, even in its interior ; or a prolongation of an inflammatory process from without, spreading deeply in the soft parts—as in neglected erysipelas.

The process, if at all acute or considerable, is seldom limited to the tissue originally affected ; both the subjacent and the superimposed tissues become involved ; the ordinary inflammatory results proceed both above and beneath ; and on these, in the latter situation, the unyielding nature of the fibrous tissue reacts most unfavourably, causing much aggravation.

Periostitis, whether chronic or acute, is from the first usually attended with great pain ; on account of the unyielding nature of the tissue affected. And when, in the acute form, the affection has involved the subjacent bone—as very early happens—then pain becomes excruciating, with great intolerance of pressure. Swelling is not great ; but

from the first tense, and very perceptible to both sight and touch, especially to the latter. At first the skin may be pale, lax, and uninvolved in the painful swelling beneath; sooner or later, however, swelling becomes more diffuse and general, and the integument grows tense, red, and tender; resembling very closely the aspect of a part affected with phlegmonous erysipelas, from which, however, it is to be distinguished by the greater degree of acute inflammatory fever by which it is accompanied. All the symptoms, but more especially the pain, undergo nocturnal exacerbation—as happens in most affections of the hard textures; and the aggravation is not least distinct in those cases which are most chronic in their nature. Day is the period of waste; night, that of repair. The inflammatory process, so far as it is constructive especially, may be considered as analogous to the latter function—nutrition in an exalted and perverted form; its nocturnal exacerbation, therefore, may be regarded as but in obedience to a general law. It is probable that the inflammatory process, wherever situated, undergoes this nocturnal change; but the occurrence is naturally most marked in affections of unyielding textures, where decided increase of turgescence, by product, must be accompanied by corresponding aggravation of pain.

Periostitis is invariably accompanied by important constitutional symptoms. If the affection be acute, there is high inflammatory fever; frequently, in children, attended with delirium. If slow and chronic, there is palpable derangement of health, of a corresponding type. The patient grows pale, weak, and thin; loses his strength, spirits, and appetite; sleep is broken, or altogether dispelled, by the nocturnal exacerbations; constitutional irritation is plainly developed; it assumes the hectic type, and may advance to most formidable severity.

The membrane is found changed; thickened, and increased in vascularity; softened in the acute form, dense in the chronic; in the acute loosened from its connection with the bone, in the chronic adhering to it with unnatural firmness. Fibrinous product forms on both its aspects; diffuse exteriorly, limited towards the bone. In the latter situation, if the process proceed no higher than the second stage, the inflammatory product, more or less plastic, may become organized. A distinct, firm, tender swelling results; termed *Node*. This consists of thickened periosteum, having in and beneath it plastic matter, which is undergoing organization; formed partly from the periosteum, partly from the corresponding surface of bone secondarily involved. And, unless either absorption return in great activity, so as to remove all excess, or suppuration supervene to undo organization, that latter process advances to completion, and the corpuscular elements become transformed into bone; the swelling then becoming less painful, more defined, hard, and unyielding. According to Mr. Goodsir, the periosteum, when raised by the product beneath, “drags out or extends the processes which stretch from its internal surface into the superficial Haversian canals; and as the texture which occupies the canals is the formative organ of bone, these retracted processes are the centres from which new deposits of bone proceed.”* In the simply fibrinous state, the swelling is termed a recent or *Inflammatory node*; when ossified, *Chronic* or *Confirmed*.

* Monthly Journal, Feb. 1850, p. 103.

When the node is connected with venereal taint of the system, it is termed *Syphilitic*; when the result of mercury, *Mercurial*. Often a combination of the two is spoken of, *Mercurio-Syphilitic*. These forms, especially the first, are usually more circumscribed and abrupt, and of a rounder form, than those nodes which are not connected with such predisposing cause.

On the cranium, ordinary nodes do not form. And when under the influence of syphilis patches of the pericranium become affected by inflammatory disease, the result is either mere thickening of the membrane; or unhealthy nutrition of the osseous lamina beneath it, with more or less opening out of the texture of the bone, accompanied with either molecular death of a portion of the diseased texture, or sometimes even with partial exfoliation. To such cases the term *Soft node* is sometimes applied.

When the process is acute, and suppuration has taken place between the bone and periosteum—instead of plastic formation there—the symptoms are greatly aggravated, by reason of the unyielding nature of the textures involved. The natural progress of the acute abscess outwards is arrested by the unyielding fibrous investment; the connections between the periosteum and bone are broken up; and the abscess extends laterally, the bone becoming more and more stripped of its membrane. The inflaming bone becomes disintegrated by ulceration at the point or points most implicated in the inflammatory process; or, being at once inflamed and deprived of its nutritive membrane, it is not unlikely to perish under the complication of evils, and become necrosed.

In acute periostitis, such destructive results may follow in the course of a few days; the system at first oppressed by grave inflammatory fever, subsequently exhausted by hectic. In the chronic form, weeks and months elapse, with but little change in the symptoms, or apparent alteration in the structural results; but with a frame gradually yet plainly yielding before the continued irritation. In the latter class of cases, the membrane is found much thickened, dense, and increased in vascularity, and unusually adherent to the corresponding bone, which has become opened out in texture, and roughened by nodules of new osseous matter, particularly around the openings upon the surface of the Haversian canals.

In scrofulous patients, chronic periostitis is common in the extremities; often involving the whole girth of the limb, for some extent; and producing such firm hard swelling as may be mistaken for solid enlargement of the bone itself. In children, the phalanges of the fingers are specially liable to this affection. Wherever situated, it is seldom accompanied by urgent symptoms; and it is amenable to constitutional treatment suitable for opposing the predisposing cause; cod-liver oil with iron proving particularly valuable.

In the neighbourhood of a joint, periostitis is apt to extend to the synovial membrane; from the tibia to the knee, for example; a serious complication.

Near the hip-joint, on the posterior part of the pelvis, Mr. Stanley has observed periostitis to be peculiarly severe, when occurring as a secondary affection after parturition. In its symptoms, it simulates

morbus coxarius ; and is apt to be mistaken for it. Unless actively and early treated, suppurative involvement of the bone may hardly be avoided.

Periostitis over the trochanter major also simulates hip-joint disease. And in this case, too, the bone is liable to suffer secondarily ; the affection ending in troublesome suppuration and necrosis.*

Examples are not wanting of the whole skeleton having been involved in periostitis. Such cases, whether chronic or acute, are obviously of a most formidable character, and can hardly be expected to have other than a fatal termination. But, usually, the disease is limited to one chain of bones, to one bone, or to a portion of one bone. The parts of the skeleton most liable to be affected are those most prone to external injury, whether by mechanical violence or atmospheric exposure ; the shin of the tibia, the ulna, the clavicle, the sternum, and the bones of the cranium, especially the frontal. In all aggravated cases, either mercury or syphilis is usually much to blame ; and the worst cases are those which occur in scrofulous patients, who have suffered from both the venereal disease and its supposed specific. The triumvirate of mercury, syphilis, and scrofula, is sadly inimical to health ; many and serious diseases are liable to be induced ; and of these, aggravated periostitis is one.

Treatment.—It is customary to state that function, healthy and morbid, proceeds with comparative slowness in bone and its investing membrane ; but such is dangerous doctrine, and may lead to inert and injurious practice. It is surely no tardiness of progress which in a few days, from simple inflammatory affection of the periosteum, brings abscess, ulcer, and necrosis—one, or other, or all. In truth, no disease calls more loudly for active and energetic treatment than acute periostitis ; for by such treatment alone can disaster be avoided. If seen at the very outset of an acute and sthenic attack, especially if of traumatic origin, leeches may be freely applied with marked advantage ; and in the robust, young, and previously healthy, general bleeding may perhaps also be practised. Our object is to make a full and decided impression on both part and system ; so as to arrest the disease while there is yet time to save structure. Where, however, the redness, tension, and pain are aggravated, and the degree of constitutional irritation is great, the sooner a free incision down to the bone is made the better, without premising any other local application. In any case, the part is kept raised, relaxed, and absolutely at rest ; while hot fomentations are diligently applied. Other antiphlogistics are not forgotten ; starvation, aconite, purgatives—perhaps calomel and opium instead. And the morbid process having been thus subdued, its results usually disappear ; gradually yet satisfactorily. If not, discussion is to be expedited by counter-irritation, and the internal administration of the iodide of potassium.

Sometimes the inflammatory process has been partially arrested by the use of leeches, or has been sub-acute from the commencement. Here direct incision is not required. But where periosteal tension exists, by inserting a fine bistoury, or tenotomy needle, at a little distance from the tense part ; passing it over, cautiously, beneath the integument ; then

* Stanley on Diseases of Bone, p. 349.

turning and pressing its edge, so as to divide the tense membrane wholly to the desired extent; cautiously withdrawing the instrument, so as to make a valvular, oblique, and subintegumental wound; and finally closing the single integumental puncture immediately, with isinglass plaster, or collodion—we obtain diffusion of the swelling, relieve tension, and so facilitate both resolution of the process and discussion of its results. This manœuvre, however, requires skill and caution in its performance; and even with these is not wholly devoid of risk. It is therefore not to be indiscriminately employed, but should be reserved for those cases which otherwise prove obstinate, and in which aggravation and suppuration seem imminent.

Whenever matter has formed, acutely, beneath the periosteum, direct incision cannot be too early had recourse to. The part is to be treated as in ordinary acute abscess. By no other procedure can the mischief threatened to the bone be either limited or averted. If the wound be early, only simple denudation of the greater portion of the exposed bone will have taken place; on evacuation of the abscess, the swelling quickly subsides, its cause having been removed; reparative effort then commences, and advances harmoniously with granulation; and hard and soft parts cicatrize together. If incision be delayed, the abscess extends, and from the interference with the nutrition of the bone due to the extensive stripping up of the periosteum, necrosis may take place to a greater extent than would in all probability otherwise have occurred.

After opening such abscesses, especially when extensive, care should be taken to prevent or arrest the progress of copious venous or capillary hemorrhage, which in an enfeebled patient is apt to occur from the abscess-sac, and might prove fatal. In all such cases, after evacuating the matter, antiphlogistics are usually inappropriate; tonics and stimulants being rather required.

In chronic periostitis we begin with leeching; but in a gentler way than in the acute form; not so much with the view of arresting or resolving disease thereby, as in order to pave the way for its more appropriate remedy—counter-irritation. A few leeches suffice; followed by fomentation; accompanied by rest, attention to posture, and a careful diet. Blisters then follow in succession; or perhaps varied with the application of a strong solution of iodine—sometimes vesicating—and accompanied by the internal administration of the iodide of potassium, in full doses. By this medicine, rest, and counter-irritation, the greater number of cases will be satisfactorily subdued. Sometimes, on account of peculiar obstinacy, more potent counter-irritation may be expedient; the hot iron may be applied cautiously over the part.

Cod-liver oil, as already stated, is an excellent remedy in chronic affections suspected to be of scrofulous connection, and is well combined with iron—more especially the syrup of the iodide. In syphilitic and mercurial cases, the iodide of potassium has a wondrously remedial power; in large and sustained doses.

Occasionally pain continues severe, more especially at night, notwithstanding perseverance in such treatment; and in these circumstances it may become advisable to feel our way with mercury, even although the case be one in which previous mercurialism is held to be the cause of

the very evil now contended with. By many the bichloride is considered the preferable form in such cases ; given cautiously, in doses of a twelfth or sixteenth of a grain, thrice daily ; either simply in solution, or in pill with sarsaparilla and guaiac ; its use to be discontinued, so soon as the symptoms have satisfactorily given way. The bin-iodide of mercury, too, is suitable. And the camphorated mercurial ointment, with extract of belladonna, or opium, forms an excellent local application in many of these cases. But, as a general rule, mercury in any form is never to be given in periostitis, especially so as to produce a constitutional effect, unless other and safer means have proved unavailing. That mineral, we well know, is as likely to cause as to cure.

Neuralgia of the Periosteum.

This membrane is sometimes the seat of neuralgic affection. It may follow amputation ; it sometimes results from a comparatively trifling injury. The part affected is usually of no great extent. The skin is free from redness and swelling, but very sensitive ; there may be no apparent change of structure in either periosteum or bone ; but in the former texture severe pain is felt, varying and intermittent—in short, presenting all the usual neuralgic characters. Rest, endermic application of the nitrate of silver, or the subcutaneous injection of anodynes, and the internal administration of iron, bark, or some other of the many constitutional remedies held available in neuralgia, constitute the treatment. This failing, benefit may perhaps be obtained from the lodgment of a seton over the affected part.

Neuralgia of Bone.

Like the periosteum, bone is liable to be thus affected. The symptoms and treatment are similar. Females are the ordinary patients ; hysterical, and of the neuralgic temperament. The head of the tibia is probably the part most frequently affected ; and, not uncommonly, some slight injury is assigned as the originating cause.

If the pain should happen to be both great and fixed, limited abscess in the interior of the bone may be somewhat closely simulated. Diagnosis mainly rests on the constitutional indications, the character of the pain, and the effect of tentative treatment.

Atrophy of Bone.

If normal interstitial absorption, in conjunction with deficient nutrition, affects the whole of a bone, the result is wasting or atrophy. Often it is an indirect and remote consequence of the inflammatory process. In what is ordinarily termed “white swelling” of the knee-joint, for example, wasting of the bones of the limb, more especially of the femur, is almost an invariable concomitant of the confinement to a sedentary or recumbent posture. Sometimes, in such cases, the wasted bones become so soft as to be readily cut with a knife. This state of matters is to be obviated by attention to the general health ; but, chiefly, by cure of the articular disease, and consequent resumption of the wonted

function of the limb. "Atrophied bone is, in some instances, simply diminished in size ; in others its walls are thinned, and its cells widened ; and, occasionally, the cancellous texture wholly disappears, and the bone after maceration presents the characters of the bone of a bird, with its simple tube and thin walls." *

Atrophy, like hypertrophy, may affect both the thickness and length of the bone ; and serious results ensue. In the lower limb, for example, the resulting lameness may be great. A flat bone, as of the skull, when atrophied ceases to be an efficient protector of important parts beneath ; and fracture is rendered possible from even slight force.

In the way of treatment, but little is in our power. In some cases, as already stated—when the cause seems to be inaction of the part—resumption of function may not only arrest the untoward change, but do something for its cure. If a scrofulous or rickety state of system exist, benefit will follow appropriate constitutional treatment.

Absorption of Bone.

This may be more or less connected with the inflammatory process, but, as a special form of disease, is altogether independent of its higher grades.

1. *Interstitial*.—By interstitial absorption affecting the whole of a bone, atrophy is produced, as just noticed. But perhaps a more important surgical affection is interstitial absorption affecting a part of a bone, by means of which its dense laminated portion is converted into a cancellated texture, its surface presenting a worm-eaten appearance (Figs. 39, 40, p. 153). Structurally, the process begins in the lacunæ of the bone. Here the corpuscles undergo multiplication ; the calcareous elements of the surrounding walls are proportionately diminished ; the lacunæ are thus enlarged ; two or three coalesce ; and thus the process extends ; a medullary fatty vascular substance occupying the spaces thus formed, for the supply of which, an additional quantity of blood being required, the Haversian canals become enlarged, and vessels permeate from them into the new tissue, which becomes more and more thoroughly vascular in proportion to the extent of area implicated, and the completeness of the disturbance of the natural process of nutrition, characterised by the completeness of the removal of the calcareous elements of the bone. This may be a slow, insidious process ; non-inflammatory ; obscurely marked by dull uneasiness or aching in the part, oedema of the superimposed soft tissues, and lividity by passive congestion of the integument. The part feels weak ; when used, it becomes soon the seat of pain as well as of fatigue, and at the same time the swelling is increased.

In itself the change is important, in as far as it entails alteration of structure, and impairment of function. But it derives its chief interest from being liable to prove the precursor of the much more formidable kind of structural derangement—ulceration of bone. The cranium and metacarpal bones are often so affected.

Sometimes a similar change seems to be produced more rapidly and decidedly, by a crescent inflammatory process, which results in ulcerative

* Stanley on Diseases of Bone, p. 7.

disintegration of the bone; occurring not continuously, but at points, bathing these in thin sero-purulent fluid. In such circumstances the symptoms are more pronounced; the part more painful and swollen. And the affection is apt to be merged, by aggravation, into a continuous and acute destruction of the bone.

In other words, we believe that the "worm-eaten" change of bone, observed in macerated specimens of disease, may result either from absorption or ulceration; in the one case, chronic and not attended with suppuration; in the other more or less acute and purulent; and that these two forms frequently occur together as gradations of the same inflammatory process.

The Treatment of the former, when occurring by itself, consists in attention to the general health, rest, and counter-irritation—gentle, but perseveringly maintained until the symptoms have satisfactorily disappeared. And then a roborant and soothing plaster may be worn for some time with advantage; as the emplastrum opiatum, spread on thick leather. Among medicines, colchicum, iodine, guiacum, mercury, quinine with opium in the rheumatic and gouty cases, and cod-liver oil and iodide of iron in strumous patients, are specially useful.

2. *Continuous*.—This is the result of pressure; sufficient to stimulate increased absorption, and to prevent normal formation of tissue; but not of such a kind as to modify the condition of the nutrient centres to the requisite degree for rousing the inflammatory process. There is gradual loss of substance; and so a cavity may be formed in the bone, even to a large extent, slowly, and sometimes almost without pain. After death, it may present, on the surface acted on by the compressing agent, the same porous aspect as that of bone undergoing interstitial inflammatory change; but pathologically it differs widely from this. There is no increased cell development, no formation of pus, no disintegrative crumbling. The parts retain their vitality undiminished; but, having their nutrition impaired by the gradual aggressive pressure, are not replaced when removed in the ordinary process of decay. So soon, however, as the compression is removed, they again become restored, more or less completely, to their normal model.

Examples of continuous absorption are afforded in the case of gradual compression of bone by aneurism, chronic abscess, solid or cystic tumours—slowly enlarging.

There is but one mode of treatment—removal of the cause; as by opening the abscess, cure of the aneurism, evacuation of the cystic tumour. No doubt, could the solid tumour be similarly removed, the healthy but expanded and partially absorbed osseous tissue by which it is surrounded would return to its natural size, shape, and condition; but as this is impossible, the portion of bone implicated must be sacrificed in order to effect the removal of the tumour.

Hypertrophy of Bone.

Bone is liable to simple enlargement, by excess of growth; slow, painless, and independent of the inflammatory process. Long bones are thus increased in thickness; and may be elongated also; producing both

deformity and lameness, and simulating other affections—as disease of the hip-joint, and curvature of the spine. When the affection occurs in short bones, more serious results may follow. The superior maxilla, for example, may enlarge so as to obliterate the antrum and the nasal passages ; also encroaching on the orbit, and displacing the eye. And, in such circumstances, extirpation of the hypertrophied bone, either in whole or in part, may be undertaken.

After partial removal, return of the growth need not be dreaded ; and therefore in most cases where surgical interference is deemed expedient, total extirpation of the offending part—could we previously be certain that it was nothing more than a hypertrophy—would not be necessary. In its early stage, the treatment suitable to chronic periostitis and osteitis should be resorted to.

Ostitis.

As already observed, periostitis cannot long exist, without the corresponding portion of bone being more or less involved. But, not unfrequently, the inflammatory process commences in the latter texture. It may affect only the external surface, or originate and exist chiefly in the interior, or involve the entire thickness ; and accordingly is termed External, Internal, or General. Also, it may be either Acute or Chronic.

Like periostitis, it may be the result of external injury, or atmospheric exposure ; or, the cause being constitutional, it may be termed idiopathic. Or the process may extend from the soft parts, involving both periosteum and bone secondarily ; as is not unlikely to happen in many cases of neglected phlegmonous erysipelas. And again, no predisposing cause is found more frequent or certain in its operation than mercury ; more especially if this have been both profusely and unnecessarily administered.

The result of the process may be Interstitial Structural change ; Suppuration, internal, external, or general ; Ulceration, simple or carious ; local Death, or Necrosis.

Change of Structure.

At first the bone is softened ; by removal of part of its earthy constituents, and an increase in the development of the corpuscular elements contained within the lacunæ, which, by accumulation, produce a tissue structurally and functionally analogous to the medullary tissue, which, in cancellated bone, plays so important a part in its development. At the same time, the texture becomes more open ; and on its surface fresh formation of bone takes place, presenting a porous appearance compared with the old lamellated structure. This is due to the large proportionate amount of soft elements, and to the increased size of the vessels in the Haversian canals, required by the increased structural activity of the affected bone. In a section, the lamellæ are seen to be separated, the vascular canals widened, and the cancelli enlarged ; new cancelli, too, are formed, by the former ones communicating with one another. And

these, as well as the canals, come to be occupied by inflammatory cellular product.

The process abiding in the minor degree, this inflammatory product passes transitionally into osseous tissue. The bone is enlarged, but still porous and spongy in texture. (Fig. 107.)

As the process falls away and becomes more chronic, organization and transition of this new and adventitious medullary tissue advance more thoroughly; and to enlargement are added both condensation and induration of texture. The Haversian canals become narrowed, and may be ultimately obliterated; section of the bone presenting a dense ivory appearance (Fig. 109). The medullary canal in the long bones, too, is often similarly encroached upon. And in consequence of this excess of earthy matter, it is important to bear in mind that the bone—now less vascular—is impaired in vital power; and therefore less likely to control a reaccession of the inflammatory process. Liability, therefore, to the destructive results of the inflammatory process—to suppuration, ulceration, and necrosis—is increased. This state of condensation may persist, but little changed. Or, by fatty degeneration, reversion into adventitious medullary tissue, and reabsorption of what is new, after long time the Haversian canals may again widen, and the cancelli regain their normal size.

When the original process has completely subsided, we are not to expect the same rapid and satisfactory disappearance of structural change, as in similar affections of the soft parts. Yet absorption is not idle. The redundancy of bone diminishes more or less. And, if inflammatory relapse do not occur, and the source of irritation does not remain persistent, after some time both enlargement and condensation may be considerably modified, and normal texture greatly restored, more especially if the natural resolute effort be judiciously seconded by appropriate treatment. Such resolution, however, can only be hoped for at a long distant date; and under any circumstances is seldom if ever altogether complete.

The progress of simple change of structure in bone is indicated by symptoms in the main very similar to those of subacute or chronic periostitis. In fact, in all these cases the periosteum, on which the bone is so dependent for its sources of vascular nutrition, is always contemporaneously affected, in greater or lesser degree, according to the site and intensity of the affection of the osseous texture of which it forms the investment. The pain is more severe than in simple periostitis, and has marked nocturnal exacerbations; it is more deeply seated, and not so much aggravated by pressure. The soft parts are early and much involved; but, at first at least, in a minor degree. In the deeper areolar tissue, exterior to the periosteum, and intermuscular, there is much fibrinous inflammatory product; clogging the muscles, impeding motion, and affording a firm, deep, inelastic swelling. In the superficial areolar



Fig. 107.

Fig. 107. Porous enlargement of the tibia; the result of osteitis.

tissue, serum accumulates ; occasioning more or less cedema. Should acute exacerbation occur, the skin too becomes red, somewhat stretched and glistening ; while the constitution sympathizes more or less, according to its susceptibility, and the intensity and duration of the disease.

Treatment is as for periostitis ; actively antiphlogistic in the outset, in order, if possible, to arrest the progress at once ; failing in this, then counter-irritant locally, alterative constitutionally. But at all times we must be ready to cease from counter-irritation, and resume antiphlogistics, should reaccession of acute disease threaten to supervene.

In the thoroughly chronic state of enlargement and condensation, no activity of treatment is either required or warranted. Time and rest are mainly trusted to ; with general management, and the internal use of the iodide of potassium.

Suppuration of Bone.

External Abscess. 1. *Acute.*—We have already seen that in acute periostitis the subjacent bone is early involved in similar affection ; that the rapid cell-multiplication of the periosteum, and superficial lacunæ, and cellular structure of the bone, collects between the periosteum and bone ; and that, if the suppurative crisis be reached, abscess there is inevitable. For such suppuration it is plainly immaterial, whether the process originate in the bone or in the periosteum ; the nutrition of the cell structures of both is soon affected. Pain is excruciating ; distinct rigors usually accompany the act of suppuration ; the swelling, which previously was considerable, increases, and ultimately fluctuation may be discerned in the centre of the dense indurated mass which surrounded the affected part ; at an early period the integument reddens and becomes painful, and the subcutaneous tissues are infiltrated by sero-fibrinous inflammatory product. By early and direct incision only, can mischief be arrested and repair satisfactorily obtained. The matter is discharged ; the irritation ceases ; and so soon as the inflammatory process has sufficiently subsided, repair begins on the part of both the hard and the soft parts, and advances towards cicatrization. If incision be omitted, matter accumulates ; tension increases, so does pain ; and then comes aggravation of the original attack. Periosteum is separated from the bone, by lateral extension of the abscess ; more and more weakening vital power in the denuded bone, by interfering with its source of vascular supply. Thus in the bone already inflaming, and with its power of controlling disease impaired—the risk of the destructive results of the inflammatory process is increased, and the area of ulceration or necrosis extended.

2. *Chronic.*—But the process may be altogether chronic and limited, and yet have reached to suppuration ; and the abscess may be small, and chronic too—enlarging slowly if at all. In such a case we are more chary of the knife. The cell elements by which the nutrition of the bone is carried on have been so gradually and gently modified in their development, that little or no destructive result occurs. Were a direct incision to be made, this might bring a certain amount of acute inflammatory accession as its direct result ; and under this, ulceration or even partial death might be induced. Such risk, therefore, is not to be in-

curred. The practice, under the circumstances, is to attempt discussion by the means formerly detailed as suitable for absorption of the chronic results of the inflammatory process. The fluid is gradually taken back into the system ; the cavity proportionally contracts ; and the bone recovers its normal state. Failing in discussion, or from any cause acute accession having supervened, then direct, free, and early incision is to be practised unhesitatingly ; as undoubtedly the less of two evils.

Chronic collections of fluid on the surface of bone, between it and the periosteum, are often connected with the syphilitic, or mercurio-syphilitic cachexy. These might seem to be peculiarly unpromising ; but they are not. Even when the bone is obviously rough and spongy, having undergone irregular absorption of its calcareous elements by the gradual changes induced by the modification of the nutritive processes, incision is to be abstained from ; and under full and sustained doses of iodide of potassium internally, with the external use of counter-irritants, rapid and permanent cure will usually be obtained.

Internal Abscess.—This may be either Diffuse or Limited. 1. *Diffuse—Osteo-myelitis.*—The inflammatory process has reached the suppurative crisis in the lining membrane and medullary substance of the interior of a bone. The pent-up pus, so soon as formed, acts as a fresh source of irritation, the area of the disease extends its limits, and diffuse suppuration of the whole soft tissues contained within the medullary canal usually takes place. At the same time a like process of suppurative cell-multiplication occurs throughout the cancellated and laminated textures of the bone, and between the periosteum and bone, so that matter is sooner or later found beneath the periosteum, and ultimately also in the more superficial soft textures ; but, as can be readily imagined, not till after some time, much agony, great swelling, and serious constitutional disturbance. The fate of bone, under such circumstances, is inevitably untoward. It must die ; and in the case of the long bones usually extensively.

The treatment is to make a free direct incision, so soon as the presence of matter can be ascertained. The pus is discharged ; further extension of mischief is probably prevented ; and an opportunity is procured, favourable for extrusion of dead parts, and for otherwise remedying the disaster already sustained. Constitutional antiphlogistics are at the same time employed ; proportioned to the symptoms. If progress towards cure be slow, discharge copious, and the natural power of the system weak, hectic is not improbable ; and the general remedies must change accordingly. Such diffuse osteo-myelitis occurring after amputation, or the removal of an exostosis, or any operation or injury implicating the medullary canals and sufficing to excite suppuration, has frequently been observed to determine the occurrence of pyæmia, and a consequently fatal result.

2. *Limited Internal Abscess.*—The occurrence of this is more rare. The cancellous texture of the heads of the long bones—more especially of the tibia—is the ordinary site. The patient is at or beyond the middle age ; and generally has been much exposed to inclemency of weather. The abscess is minute, the suppurated part seldom exceeding the space of a shilling in extent ; and it is surrounded and limited by dense firm bone—obviously the result of the usual plastic change peculiar

to the second stage of the sthenic inflammatory process. The suppurated space is usually lined by a distinct pyogenic membrane; and the pus is thick and creamy. The whole process has been plainly chronic as well as sthenic—a combination not usually found in other circumstances.

The texture around becomes affected by osteitis, of a minor grade—still chronic; causing gradual enlargement, and ultimate consolidation, of the whole bone at that part.

The limiting dense bone serves both a good and an injurious end. It is plainly analogous to the limiting ring in abscess of the soft parts; but is not alike salutary. For while it divides the surrounding parts from the purulent result of the inflammatory process, it also prevents, from its density of nature, anything like accommodating expansion before the accumulating pus; increasing greatly the pain and constitutional affection, delaying or altogether preventing the spontaneous evacuation of the abscess, and tending to acute exacerbation of the original disorder. Unless relief be afforded, a more formidable inflammatory process may invade the whole affected part; osteo-myelitis; suppurative, diffuse, destructive, with proportional aggravation of local and constitutional disorder.

If inflammatory accession remain aloof, however, the limited form may endure for many months; slowly enlarging, perhaps, and becoming more and more densely surrounded by new bone.

If situated close to a joint, there is risk of its progress causing purulent irruption into the cavity; intense synovitis resulting—usually destructive.

The symptoms of this affection are very marked. Great pain, constant, and rather on the increase than otherwise, is felt in one fixed spot, of limited extent. At that point the skin may be red, but not tense; and only slightly swollen, if at all. Some increase of pain results from firm pressure; but such increase is infinitely below what would accrue from direct compression of a part primarily inflamed. The superficial bone and the soft textures above have become involved in a minor grade of the inflammatory process; and it is from compression of these that aggravation of the pain occurs. As usual, nocturnal exacerbation is present. A sensation of weight and throbbing, as well as of pain, is complained of in the centre of the bone; and to that spot, on which he can at once lay his finger, the patient unhesitatingly attributes all his affliction. No ordinary antiphlogistic treatment, however active, affords



Fig. 108.

relief. Constitutional disturbance is more of the irritative than of the inflammatory type; sleep is almost wholly denied; and not unfrequently delirium occurs. By continuance, the system is gradually exhausted; the fever changes into hectic; and this may prove so urgent as to demand amputation. More than one mutilation has been performed above the knee, which should have never happened; seeing that perforation of the

Fig. 108. Limited internal abscess in lower part of tibia. Section of bone. Prep. in Royal College of Surgeons' Museum, Edinburgh.

head of the tibia, and evacuation of a small abscess there, would have sufficed to resolve all the urgency.

Sometimes remarkable intermission of the symptoms occurs ; probably in consequence of the matter having found either a partial or complete vent from its original site. When such intermission does take place, the case may closely simulate neuralgia.

It has been already observed, that usually, unless efficient relief be afforded, aggravation and extension of the original affection occur ; involving the whole bone at that part in suppuration, ulceration, and death. Then the constitutional symptoms undergo proportional aggravation. Sometimes, however, the progress is more gradual. Absorption and ulceration occur in the parts surrounding the abscess ; this slowly enlarges, and, obeying the general law, enlarges chiefly towards the surface ; the surface is ultimately reached, the matter discharged, and the bone relieved. Not unfrequently, one or two small sequestra are extruded along with the matter. But this is both a painful and a protracted process ; occupying not days, but weeks—perhaps many ; and ever liable to be merged in general acute osteitis and death of the bone. Even supposing that such accession do not occur, constitutional disorder will be inevitably great, and, in consequence, life may be endangered, or saved only at the cost of the limb.

Treatment is simple. Instead of the amputating knife and saw, at an advanced period of the case, we employ the scalpel and trephine at the beginning. Ordinary means having failed to arrest the inflammatory process, and the symptoms being sufficiently plain to convince us that a limited internal abscess has formed, we make a free incision over the marked spot ; and there apply the crown of a trephine ; perforating towards the interior. On reaching the cancellous texture, pus will probably begin to ooze by the side of the instrument. In withdrawing the trephine, along with the laminated portion of bone which it has detached, a tea-spoonful or two of tolerably laudable pus may escape ; and then, evacuation having been fully accomplished, the patient passes almost at once from most cruel torment into placid repose. The flaps are replaced, and the wound treated on ordinary principles. The part soon quiets down, and ultimately cicatrizes firmly and permanently.

Should the first trephining fail to detect pus, and the symptoms yet be most convincing of its presence, the instrument may be reapplied ; with hopes of a better success—as is well exemplified in a case detailed in Liston's "Elements," p. 116. But to obviate the necessity for this, it is well to use a specially large trephine in the first instance.

In some cases it has happened that although no pus or suppurated cavity has been detected, relief and cure have still followed the operation ; probably by the relief of tension.

Fig. 109. Section of femur, shewing great condensation. Near the middle, an abscess has discharged itself, at some remote period—not, however, before having proved the cause of extensive structural change.



Fig. 109.

By such comparatively simple procedure, both life and limb may be saved ; an important fact ; for which our profession stands indebted to Sir Benjamin Brodie.

It should not be forgotten, however, that a sub-acute inflammatory process in bone, attended with no further effect than a change of structure, may readily be mistaken for internal abscess ; and therefore that no

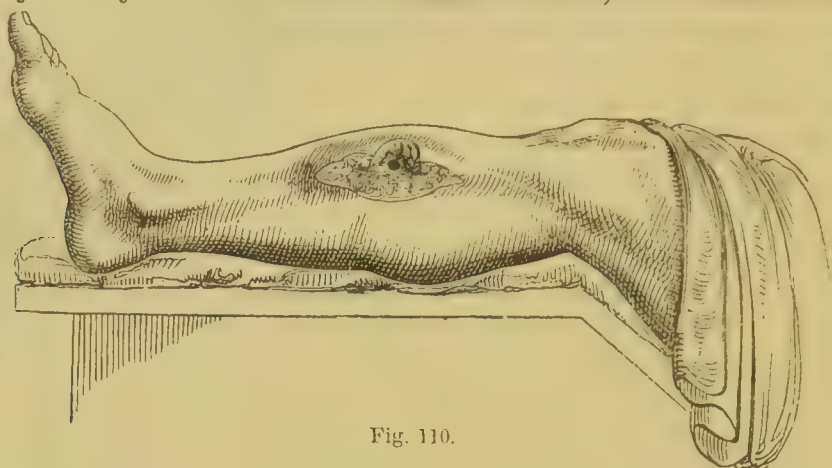


Fig. 110.

operation should be resorted to until the treatment suited to mere structural change has had a fair trial and failed.

Chronic Internal Abscess.—This may result from the acute ; the inflammatory process subsiding, no primary osseous barrier of limitation existing, and pus continuing to be formed not more rapidly than the surrounding parts can accommodate themselves to by slow expansion. Or the inflammatory process is chronic throughout. The laminated texture is gradually distended ; and the cancellous is either condensed, assisting to form the thickened parietes of the cavity, or is removed by absorption. Sometimes the death of small portions of the interior of the bone has been the result of the inflammatory process ; and these become detached, and mingle with the fluid contents. The cavity steadily enlarges. Its contents are purulent, but usually thin ; commingled with the ulcerative debris, and, as just observed, often containing small sequestra. A distinct pyogenic membrane lines the interior ; and the walls consist of the expanded laminae of the bone, strengthened from time to time by recent osseous formation on the exterior. On making a section of bone so affected, its laminated portion is sometimes found, notwithstanding much expansion, considerably thicker and more dense than in the normal state. At one point, however, attenuation of the parietes by absorption usually does take place, though very slowly : and there ultimately discharge may be effected.

The symptoms, like the morbid process, are of a chronic nature throughout. A dull indolent swelling forms gradually ; with more or less affection of the superimposed soft parts, and irritation of the system. The affection is liable to be mistaken for a tumour forming in the interior of the bone, or for chronic node.

Treatment consists in perforation of the parietes, at the prominent and thinnest part. A bistoury may be sufficient for this alone ; or the

Fig. 110. Internal abscess affecting the tibia, near its centre. Cured by the trephine. Patient a policeman, æt. 22. Case narrated in Liston's "Elements," p. 117.

assistance of a small trephine may be required. The purulent contents are thus evacuated; and an efficient draining of them is ensured, by establishing a second and more dependent aperture, if necessary:—opening followed by counter-opening. Granulation and repair advance in the interior; by uniform support externally, from bandaging, centripetal contraction of the parietes is favoured; and thus slowly the cavity may disappear, the discharge cease, the swelling in some measure subside; and both symmetry and usefulness may be at least partially restored. But not unfrequently, as can readily be imagined, progress towards cure is interrupted, the part threatening to remain open; in such circumstances, stimulation of the interior by injections, as of sulphate of zinc, is likely to prove beneficial. And if these fail, a seton may be lodged temporarily, so as to excite fresh inflammatory accession; which, on subsidence from the suppurative stage, may carry on repair with a renewed and more successful energy. If the cavity be large, and its parietes thin and superficial, the process of cure may be abbreviated by removing a part of these, and then dressing the wound so as to ensure contraction and cicatrization from the bottom.

Scrofulous, or Tubercular Abscess of Bone.—This is of indolent and chronic origin; liable to acute exacerbation. It is situated in the cancellous texture; in the bodies of the short bones, or in the articulating extremities of the long ones. The cancelli of the bone having become enlarged, by thinning and even complete absorption of their walls, the contained medullary substance, presenting a rosy or purplish congested appearance, tends, as the disease advances, either to undergo fatty or suppurative change. Thus, the whole bone becomes expanded, and perhaps even soft and compressible. The formation of tubercular matter, according to some, is supposed to take place in the cancelli, as a common consequence of these preliminary pathological changes; and certainly here and there yellow tubercular nodules may be observed, in making sections of cancellated bone in scrofulous patients. There is, however, good reason to believe that these are merely the remains of purulent collections, and consist of accretions of shrunk pus corpuscles, and not of true tubercle. In bone affected in this way, there are usually indistinct symptoms of a chronic or subacute inflammatory process having preceded this change in the nutrition of its cancelli. Such cheesy purulent formations having accumulated in some quantity, an inflammatory process supervenes; spontaneously, or by external injury. The old solidified pus crumbles down, becoming mixed with a new purulent formation. And this matter may be either limited by a pyogenic membrane, or become diffused by extension of the corpuscular multiplication in the surrounding parts; most frequently the abscess is of the diffuse cha-



Fig. 111.

Fig. 111. Chronic abscess of tibia—of large size. Bone much thickened as well as expanded round the cavity. Prep. in Royal College of Surgeons' Museum, Edinburgh.

racter. According to the site, either the general surface is approached, and the cheesy debris, with minute fragments of bony spicula and pus, thence discharged; or a neighbouring articular cavity is opened into, and by such irruption grave inflammatory mischief is excited in it.

The symptoms are, first, uneasiness and weight, rather than pain, deeply seated in the bone, increased somewhat by pressure and considerably by motion; and occurring in a patient of an obviously strumous habit. Enlargement of the bone then takes place at that part, with increase of the uneasy sensations; the superimposed soft parts become œdematous, and the skin assumes a bluish colour. On occurrence of the suppurative crisis, enlargement becomes more rapid; pain increases, but yet is comparatively dull; shivering takes place, and the system thereafter sympathises more or less. When the surface is approached, erysipelatous redness, fluctuation, and pointing may present themselves, unless incision be premised; and, an opening having formed, the usual characters of the scrofulous sore are exhibited, with the addition of this disease of bone at the bottom of the cavity. When, on the other hand, an articulation is opened into, violent aggravation of both local and constitutional symptoms follows; as will be afterwards described.

Sometimes, but very rarely, the cheesy matter, instead of undergoing inflammatory degeneration, may become changed into a mass of earthy matter; as more frequently happens to tubercle in the lungs.

Treatment should be mainly prophylactic. By rest, fomentation, and attention to the general health at first, it is our object to limit chronic inflammatory change, and prevent its suppuration. Leeching, or other antiphlogistics, injure the system; and counter-irritants, of any high grade, in addition to a similarly evil effect, often seem to hurry onward the local disease. The best remedies are general hygiene, with sea-air, cod-liver oil, and chalybeates; the iodides, also, being sometimes well borne. When suppuration has occurred, we have little or no power of controlling the untoward progress. All that we can do is to evacuate matter by incision, so soon as its presence has been detected—seldom until it has appeared in some quantity in the soft tissues; mitigating, meanwhile, as we best may, both local and general symptoms, as they arise.

When, under scrofulous disease, bone has been destroyed to any considerable extent, reproduction seldom if ever occurs. And hence, in scrofulous loss of substance, so common in the phalanges of the fingers in young people, shortening of the fingers inevitably results; proportioned to the amount of bone destroyed.

General Suppuration of Bone.—The abscess is neither external nor internal, but both, pervading the whole bone, and invariably acute; the result of intense general osteitis. The bone so affected dies, more or less extensively; and is bathed in a profuse secretion of pus, which not only burrows under the periosteum, but lodges also in the general soft parts, rapidly making its way to the surface. In fact, the case is one of acute necrosis.

The ordinary symptoms are—shivering; violent, deep-seated pain, constant, and increasing; great swelling of the limb, obviously of inflammatory origin; redness of the integument, as if erysipelatous;

constitutional disorder, severe, and of the sthenic inflammatory type. Matter forms, and is discernible in the soft parts ; deep, in contact with the bone. It approaches the surface at one or more points, and is discharged by either an artificial or spontaneous aperture. Soon thereafter, the inflammatory fever may pass into hectic. The acute stage—abscess—has gone by ; the chronic stage—necrosis—has become established.

Treatment should be both active and early, both general and local, as in acute otitis and periostitis. When matter has formed, free incision is required ; not to prevent necrosis—for that is impossible—but to limit its extent, and favour the natural process of cure.

Ulceration of Bone.

This may be simple and tractable—*Ulcer* ; or peculiar, and difficult of cure—*Caries*.

1. *Simple Ulcer* of bone is the ordinary product of an advanced inflammatory process ; as in the analogous condition of the soft tissues. The inflammatory process is invariably its direct cause. As a soft texture may inflame, suppurate, and ulcerate, so may bone ; the inflammatory process originating in, and, as a destructive process, mainly limited to, the ulcerated part. When an abscess, forming in connection with bone or its periosteum, is evacuated, it might be supposed that the rough spicular surface of bone has been produced by the pressure of the matter “eroding” the bone, or causing ulceration. This, however, is a mistake. The disease of the bone has given rise to the suppuration, not the suppuration to it. When continuous pressure acts upon bone, we have already seen that it produces absorption ; and so, when pus, pent up within the interior of a bone, works its way to the surface, the aperture or *cloaca* by which it escapes is not formed by ulceration, nor does it present any of the appearances of ulcer in bone. It is formed by continuous absorption, and its surface is covered by a smooth membranous expansion like the pyogenic membrane of an abscess.

The destructive process is simple, like its analogue in the soft textures. It commences in the same structural changes, already described as attending upon the inflammatory process in bone. First, the bone becomes more porous, its lacunæ enlarged, its cancelli confluent from absorption of their walls, its Haversian canals enlarged, its textures more vascular and succulent. Then suppurative death of the lacunar corpuscles in a limited area is accompanied with breaking down of the calcareous texture, which depends on them for nourishment ; and while the ulceration extends, this death and suppuration of cell structure, and molecular disintegration, must commensurately continue. Whenever the inflammatory process which determines these fatal results diminishes from its destructive grade, ulceration also ceases, and the process of repair succeeds. The healing process is quite analogous to what takes place in the soft parts. There are constructive results of the inflammatory process, as in the healing ulcer of soft parts, more particularly in the neighbouring bone ; and this new matter is converted into bone, constituting, in the macerated specimen, osseous spicula. By these the

surface of the bone around the area of the ulcerative change is more or less copiously studded, and the supply of such new material is usually in proportion to the continuance of the irritation. When the irritation attending on the ulcerative process ceases, all further marginal formation of bone ceases too ; and in most instances the spicula become absorbed, while the granulating surface, lately the site of ulceration, becomes to some extent converted into a thin layer of new bone. The surrounding bone, being an inelastic texture, does little towards diminution of the chasm by centripetal movement. Something, however, is effected by absorption. While the excavated surface is scantily developing new osseous matter, interstitial absorption is advancing in the margins, which

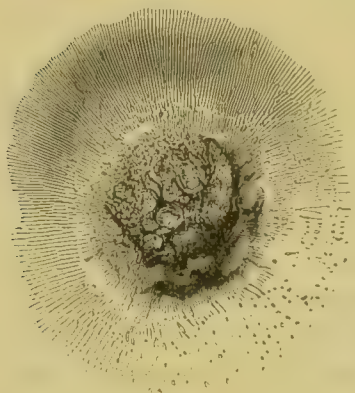


Fig. 112.

are, as it were, bevelled off thereby ; and, ceasing to be either occupied by new osseous developments, or even to retain their former healthy elevation, they slope gradually towards the central depression. Thus, partly by reparation of the surface of the ulcer, partly from levelling of the surrounding margins by absorption, the cavity comes to be gradually diminished ; and the superimposed soft parts, meanwhile busy in bringing themselves into a state suited to granulating repair, now coalesce with the osseous granules beneath, and interweave hard texture with soft, into a fibrous substance ;

which, ultimately skinning over, gives a firm, depressed, solid, white, permanent cicatrix.

Sometimes the soft parts heal by themselves, independently of the bone ; filming over, while the ulcer beneath is yet unclosed. The cicatrix then is elevated, movable, evidently unconnected with the bone, livid, soft, and painful ; certain soon to be undone, by reaccession of the advanced inflammatory process ; disclosing the ulcer beneath, perhaps wider and deeper than before.

Ulcer of bone, though originally simple, and well-disposed to heal, may, from its extent, its site, or by reaccession of the inflammatory process—and consequent vacillation in its progress—degenerate into a weak or indolent condition, tardy and inefficient in repair ; as happens, under similar circumstances, in the soft parts.

Treatment is conducted on principles precisely similar to those which regulate that of the cutaneous sore. Rest, water-dressing, and antiphlogistic regimen, during the inflammatory and ulcerative stages ; not forgetting removal of any obvious cause at the outset ; then water-dressing, medicated so as to gently stimulate ; external support by uniform bandaging ; and maintenance of the *vis vitæ* by suitable regimen, so as to insure activity of repair.

2. *Caries*.—This may follow on the simple sore. More frequently it is original. It is something more than a weak ulcer of bone. With

Fig. 112. Ulcer of cranium, healed. The margins bevelled off, and sloping down. The surface studded with imperfect granulation. From the same cranium as Figs. 39, 40.

many, there is much laxity in the use of the term ; applying it indiscriminately to all breaches of continuity in bone, of whatever kind. We shall endeavour to define the state of matters to which we apprehend that the term Caries is truly applicable, and shall use that word only to denote that condition ; remembering the just saying of Mr. Pott, how “ clear and precise definitions of disease, and the application of such names to them as are expressive of their true nature, are of more consequence than they are generally imagined to be. Untrue and imperfect ones occasion false ideas, and false ideas are generally followed by erroneous practice.”

Caries, then, we consider to be an ulcerated condition of bone of a peculiar kind ; practically consisting of three parts—1, The ulcerous, or molecularly disintegrating, and suppurating surface itself ; consisting of fine, needle-like spicula, mixed up with the medullary substance, which presents the appearance of soft, weak granulations ; 2, A portion of bone next to this, opening up in texture, by absorption of the walls of the cancelli, and fusion of the cancelli with each other ; 3, The bone beyond this again, firm and sound, or even unduly condensed ; undergoing the second stage of a sthenic inflammatory process, and evidencing its reparative energy by studding itself by firm osseous nodules. In dense bones, caries is preceded and accompanied by an opening up of the tissue, as formerly observed ; cancellated texture seeming to be its proper nidus ; and inflammatory transformation of laminated bone into a kind of cancellated tissue seeming to be an essential prelude to its accession, in those parts



Fig. 113.

where cancellous texture does not naturally exist. The margins of the cavity, consequently, have not the abrupt and firm character of the simple ulcer ; but are soft, spongy, and worm-eaten in appearance. The ulcer itself is sometimes of uniform level ; more frequently it is unequal ; deep at one point, and comparatively shallow at another. It has no adequate power of reparation. It is either open and uncovered, as if either inanimate or still undergoing disintegration—a probe passing crumblingly into it, as into soft decayed woody fibre. Or it is invested by tall, pale, fleshy granulations ; which seem altogether incapable of completing transition into bone. The ulcerative process is rather chronic than acute. Sometimes the bone is extensively and rapidly destroyed ; more commonly, destruction is slow and gradual, even when great. Not unfrequently only a slight extent of the bone's surface is involved ; even in cases of old standing. The whole of a small bone, even the whole of a chain of small bones, or all the articulating

Fig. 113. Example of Caries in the metatarsal bone of the great toe. Two carious ulcers ; each surrounded by interstitial absorption ; as well as by attempts at reparative effort.

extremity of a long bone, may be attacked ; or a thin external portion alone may suffer. A thin, fetid, purulent discharge, often bloody, always acrid, usually more or less mixed with ulcerative debris, and often containing small detached sequestra, exudes in considerable quantity. The corresponding soft parts are swollen and broken up by suppuration ; and one or more apertures exist in the integument, presenting the characters sometimes of the weak, sometimes of the scrofulous, sometimes of the irritable, sometimes of the inflamed ulcer. A probe, passed through these apertures, reaches the bone, and is found to sink into it ; readily, with the application of little or no pressure, if the surface be uncovered by soft parts ; but not without pressure, if investing granulations exist, as frequently is the case. In using the probe, this must be borne in mind ; otherwise fallacy of diagnosis is not unlikely to be incurred. Sometimes the probe may be freely used, and little pain ensue ; but more frequently even its lightest movement causes much suffering, and bleeding of a dark oozy kind ; both pain and bleeding being due to the soft parts of the medullary structure, rather than to the bone. Usually there is smart pain in the part, even independently of external interference.

As already stated, the diseased portion may be conveniently considered as consisting—usually, though not invariably—of three parts. Suppose a cancellated bone, such as the os calcis or astragalus, affected ; the ulcerous surface is usually central ; and with it the sinus, opening upon the surface, communicates through an aperture in the thin laminated crust of the bone. If a section of the bone is made so as to expose the affected part, the section displays in the centre a soft spongy substance of a dark purple, maroon, or rosy tint. This resembles granulations in structure, and is copiously supplied with blood-vessels. On washing with water, and carefully picking out the soft granulation-tissue with forceps, a delicate framework of fine needle-like osseous spicula, of a translucent or opaline colour, becomes apparent. To it the granulations are not adherent. It has no membranous endosteal expansion covering it, and no blood-vessels entering it. A portion examined by the microscope contains no vessels, and no corpuscles in the lacunæ. This spicular network is, in fact, the calcareous remains of the walls of the cancelli ; but no longer a vital structure capable of reparation, but a dead skeleton or framework which supports the vascular medullary tissue ; a dead texture which acts as a foreign body, keeping up irritation and suppuration, and determining the suppuration of that medullary tissue by which it is enveloped. Beyond this, but continuous with it by a gradual transformation, we find the cancelli enlarged, and occupied by a very vascular medullary substance, adherent to their osseous walls. A portion of this bone, examined microscopically under favourable circumstances, will shew the lacunæ enlarged, and crowded with corpuscles ; fusing together, and thus opening up the texture of the walls of the cancelli ; piercing them through, and leaving in their place the product of corpuscular reproduction in the form of a vascular medullary or granulation tissue, continuous with, and structurally identical with, the medullary tissue occupying the normal cancelli of a spongy bone. Beyond this area, the irritation produced modifies the nutritive process in such a manner, that the walls of the cancelli become thickened at the expense of the medullary

substance, which is diminished by the transformation of its connective tissue into bone. This part of the bone in section is tough, dense, and almost ivory-like ; and when this outer area affects the subperiosteal surface of the bone, it becomes developed into osseous spicula, ridges, and stalactitic projections. The two interior portions are incapable of efficient restoration or repair ; the external is busy, as it were, atoning for their deficiency, by throwing out new osseous matter, sometimes in great abundance. Thus the carious spicular cavity, filled with the softened results of the retrograde transformation of fully-developed bony tissue, is surrounded first by spongy bone ; and more exteriorly by osseous product, forming a hard irregular ridge, sometimes but slight, at other times extensive. It is not meant that such an arrangement is perfect in all cases, but only that it obtains to a greater or less degree.

Sometimes continuous necrosis is engrafted on the ulcerative process ; and in the cavity may be found dead portions, either of cancellated or laminated texture ; partially adherent, or altogether loose as sequestra.

The system invariably suffers to a greater or less extent ; and the disorder is of the asthenic type—constitutional irritation. Very often the



Fig. 114.



Fig. 115.

patient has been for some time manifestly cachectic, previously to the accession of local mischief. If not, symptoms of a hectic character are not long in supervening ; all the more early and formidable, if the caries implicate an important articulation.

Caries may be *Simple*, as just described ; or it may be of a *Scrofulous* or *Tubercular* character. In the former case, it is unattended by any peculiar product. In the latter, it is often both preceded and accompanied by the formation of purulent tubercular accretion in the loose texture of the bone ; originating, in fact, in the morbid condition formerly detailed as constituting scrofulous abscess of bone. First, there is tubercular occupation of open texture, either originally cancellous, or rendered

Fig. 114. Caries of the elbow ; mainly affecting the condyle of the humerus. The vegetative effort around the carious surface well exemplified.

Fig. 115. Necrosis and Caries combined ; in phalanges of the toes. In the upper, the carious cavity represented still containing its sequestrum. In the lower, the cavity and sequestrum separate.

so by interstitial change ; then disintegration and suppuration of this. From the ultimately open condition of the abscess, the state of ulcer necessarily results ; and the cavity of the ulcer is more or less occupied with masses of a lardaceous character. The soft parts present the usual appearances of a scrofulous sore ; and the system, both before and during the progress of the local disease, shews the ordinary signs of strumous cachexy ; latterly aggravated by more or less of hectic. During the suppurative stage, irritative fever is not unlikely to be present.

Causes.—As already stated, Caries may be primary ; or secondary, an originally simple ulcer having so degenerated. Sometimes the bone is not the texture first involved. Infiltration and suppuration, tubercular or not, may have occurred in the soft textures ; and thence disease may have extended to the neighbouring bone. Or the disease, commencing in the encrusting articular cartilages in the periosteum, may implicate the bone. Or an intractable ulcer of the soft parts may come to implicate the subjacent osseous structure ; as in lupus.

By some, the affection of bone which follows on the truly malignant ulcer or tumour of soft parts is termed caries ; but unjustly. It is a truly malignant or cancerous ulcer ; just as different from true caries, as open cancer is from a simply weak or irritable sore.

In the tubercular caries, scrofula is of course to be considered as the



Fig. 116.



predisposing cause ; any slight external injury may serve for the exciting. Syphilis may induce ulceration of the cranial and other bones ; the poison often seeming to enact the part of both predisposing and exciting cause. And the same may be said of mercury ; perhaps with greater truth—at least in those cases in which that mineral has been given both sakelessly and in profusion. An unfortunate conjunction of the two poisons — mercurial and venereal—in a scrofulous system, is the parent of the worst, and not least frequent forms of ulceration.

Treatment.—Prevention is obviously the paramount indication. With this view, if symptoms of inflammatory interstitial change be present in a part, our attention will be directed to the arrest of this ; by rest, counter-irritation, and constitutional care. If a simple abscess or ulcer occur on the surface of bone, it will be our object to effect the healing of this as rapidly as possible ; in order to prevent irritation. When mere otitis is present and demands our aid, we shall treat it actively yet warily ; actively, in order to arrest the inflammatory process, ere yet the untoward

Fig. 116. Mercurio-Syphilitic disease of the skull. *a*, A portion detached, in the form of sequestrum.

results of suppuration or ulceration have occurred ; warily, avoiding exhaustion of the system, and still more the poisoning of it, by excess of mercurial and other active antiphlogistics ; careful not to induce a state favourable to the occurrence of destruction in bone.

When caries has occurred, the indications of local treatment are abundantly simple. We are to take away the two portions which are incapable of healthy effort—the interstitially rarified and softened, as well as the truly ulcerous ; leaving a solid foundation of normal texture, not only capable of, but already engaged in, the business of efficient repair. Afterwards, the part is to be treated as a simple ulcer ; our anxious care being directed to speedy yet efficient and certain closure, lest renewed degeneration supervene. Not resting satisfied with a blue, elevated, soft and spongy cicatrix ; but insisting on the establishment of one which is firm, white, depressed—plainly incorporated with the bone.

For effecting the removal, cutting instruments are infinitely preferable to escharotics, in all situations where excision is practicable. But, as a general rule, no operation of any kind should be performed on the bone, unless the adjacent and superimposed soft parts are in a quiet state. They may be undergoing the acute inflammatory process ; they may be the seat of acute suppuration, of acute ulceration, or of both ; and removal of a portion of bone, imbedded in such soft parts, is almost certain not only to prove futile as a means of cure, but actually to aggravate and extend the disease. The then carious portion of bone may be taken away ; but ulceration, instead of reparation, is certain to ensue, and the carious condition is renewed. Or a more intense and general osteitis is kindled ; and the partial caries is merged in general necrosis. And even supposing none of these untoward events to occur, still the time of operation were inexpedient ; as causing an unnecessary and therefore an unwarrantable amount of acute inflammatory change.

The soft parts being already quiet, or having become so under suitable treatment, free incision is made through them ; so as effectually to expose the diseased portion of bone—previously tolerably well explored by judicious use of the probe or finger. The extent of the doomed parts having been satisfactorily ascertained, their thorough removal is then to be accomplished ; by the saw, trephine, bone-pliers, or gouge, as circumstances may render expedient. As a general rule, the saw is preferred to the pliers ; just as, in soft parts, the knife is preferred to scissors. A cleaner wound is made ; there is less bruising ; and, therefore, untoward inflammatory accession is less likely to supervene in the line of wound. The articulating extremity of a long bone may be readily taken away by the common saw, or by a smaller straight-edged instrument. In a flat bone, such as the cranium or scapula, the trephine may be more convenient. And in many situations, where either the previously mentioned instruments are inapplicable, or when by them we have already taken away much but cannot remove all, our object may be gained by an instrument closely resembling the carpenter's gouge ; firm, well tempered, and of a sharp edge ; used lightly, so as not to crush but cut ; and yet used determinedly, so as to ensure ablation of all the texture prone to renewal of ulceration, and incapable of repair. Some employ a rasping instrument (*osteo-trite*), with a rotatory movement, to effect the same object.

Escharotics may sometimes be employed ; as for example, when the patient resolutely objects to any other mode of removal. Also, when cutting instruments have been used, and yet a border of suspicious character remains, the extinction of such a suspected part may be conveniently enough entrusted to cauterization. The actual cautery may be applied ; but unwisely. It effects too much. The carious part is at once and satisfactorily killed ; but, as happens in all severe burns, the texture immediately surrounding the eschar, though escaping with life, has its vitality very much impaired, and is more prone to disintegration than repair. The potential cautery is infinitely preferable. It destroys the diseased part just as effectually, though perhaps with less rapidity ; and



Fig. 117.

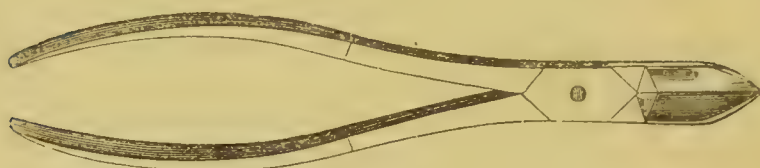


Fig. 118.

at the same time the immediately adjoining parts do not in anywise suffer, but at once institute a healthful line of demarcation for removal of the dead part, and are well able to commence at the same time a sthenic process of repair. The preferable form of potential escharotic is the chloride of zinc made into a paste. Application is made with intensity deemed sufficient to ensure death of all the suspected part ; and the escharotic is then removed. The whole wound is filled gently with lint ; and such dressing is continued, covered perhaps by a poultice. After separation of the eschar, the bone's surface is treated as a simple ulcer.

Certain parts of the skeleton are liable to caries, and not accessible to either knife or caustics ; as the bodies of the vertebræ. In these, the main reliance for cure must be placed in Nature ; the surgeon is qualified only to look on and assist—when he may. But as, under such circumstances, ordinary indications of cure cannot be carried out—or at least can only be slowly and imperfectly fulfilled—prognosis is unfavourable. It is still essential that the carious surface shall be thrown off, and a healthy foundation for repair obtained. This can only be accomplished by an effort of the part itself. By the process of nutritive change the unnaturally cancellated part is converted completely into medullary tissue, without proceeding to suppuration ; and while the dead spicular fragments are either extruded as a whole, or in small fragments, the formation of pus ceases, and the granulation-substance and medullary tissue become again transformed into cancellated bone. Or such discriminative separation may be accelerated, or at all events mixed up with more continuous death of the

Fig. 117. Gouge. Suitable for effectually removing the carious texture.

Fig. 118. Cutting bone-pliers ; commonly called Liston's forceps ; shut ; for dividing the diseased bone—as in resection of carious joints.

unprofitable part—necrosis. Such destructive process is necessarily acute, and follows the course of an acute abscess which, with its contained debris, and perhaps sequestra, finds its way to the surface in the usual manner; and is thence discharged.

The auxiliary treatment afforded by our art, in suspected disease of these inaccessible parts, is in the first place to prevent occurrence of caries if possible, by attention to the general health, rest of the part, and counter-irritation. When caries has doubtless begun, we do little more than abide the working of Nature; watching over the general health, and maintaining for the affected part a complete immunity from motion. But when the work of destruction has become acute, and the indications of advancing abscess are plain, the question immediately arises as to the expediency of incision. In general it is well to carry out the general

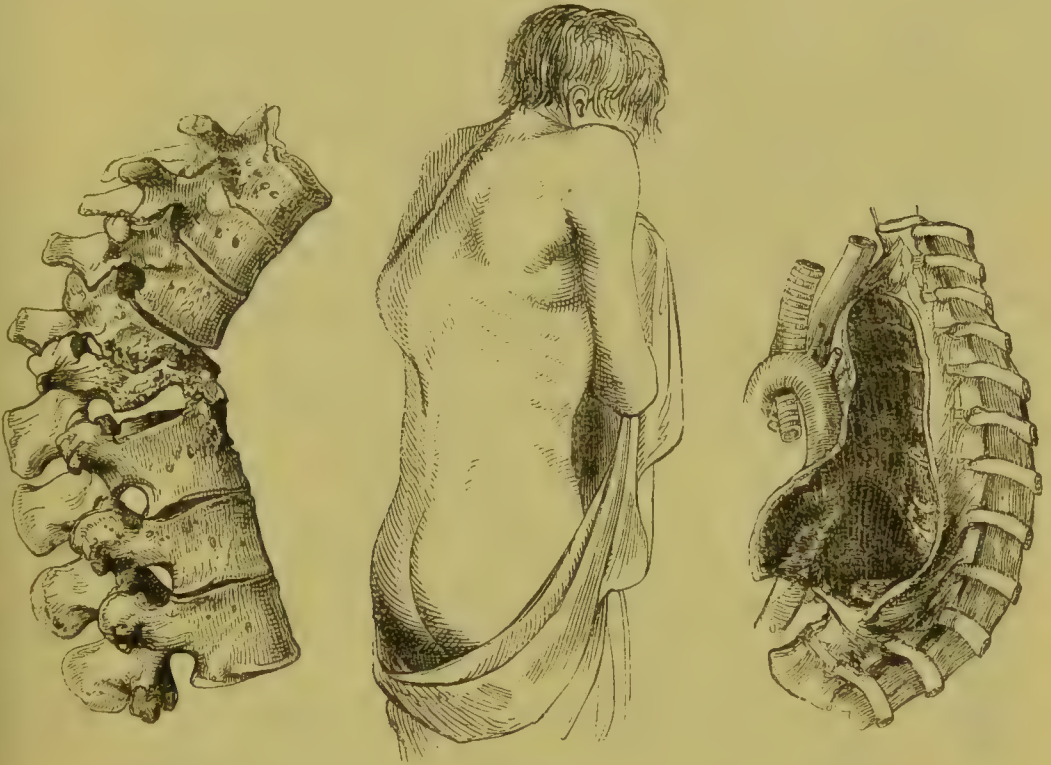


Fig. 119.

Fig. 120.

Fig. 121.

principles of surgery, by opening the dependent or pointing part freely. The inflammatory process which necessarily follows we anxiously watch, and may perhaps attempt to subdue; while the powers of the general system are husbanded and maintained.

It can be readily understood, however, that in but few cases a successful issue is to be expected for this natural process of cure. By ulceration the original carious surface may be destroyed; but, most probably, only to induce a continuous extension of the carious state. A sound portion of bone, fit for repair, may never be reached; every successive effort of separation and repair, as in progressive senile gangrene, ending

Fig. 119. Caries of the vertebræ; macerated; the bodies extensively destroyed; marked incurvation forwards.

Fig. 120. The same during life.

Fig. 121. Caries of the vertebræ; previously to maceration. The aorta overlays the cyst of the abscess.

only in failure and loss. The system may be gradually worn out by the suppuration and its hectic. Or under the formidable irritative fever which follows the open condition of the abscess, the patient may speedily succumb.

Death of Bone, or Necrosis.

This may be the immediate result of external injury, the bone at once parting with its vitality ; as in extreme burns, in which all the component textures of the limb are instantly converted into an inanimate eschar. Much more frequently, it is the indirect result of injury ; the bone perishing by an overpowering inflammatory attack. When unaccompanied by any other form of disease, it is said to be Simple ; Complicated, on the other hand, if combined with caries, or attendant on fracture, as not unfrequently happens. When consequent on wound or other external injury, it is called Traumatic ; Idiopathic, when originating without any appreciable exciting cause. Often in the young, a bone, with its periosteum, is seized upon by an acute and intense inflammatory process without any apparent reason, rapidly becomes the seat of suppuration, and dies to a greater or less extent.

Also, necrosis may be either *Chronic* or *Acute*. Or, rather, the osteitis, which leads to local death, may be either chronic or acute. For the major part of necrosis—that is, separation of the dead portion of bone, and formation of its substitute—is invariably chronic ; at least occupying long time in its completion.

The extent of necrosis is very various. A mere leaf or scale of bone may perish on the external surface ; and this is termed *Exfoliation*. A larger and considerable portion of the laminated texture may die ; or this may retain its vitality, while the cancellated interior perishes. The dead portions, or *Sequestra*, are called External and Internal accordingly ; and like terms are applied to the necrosis. Or the whole thickness of the bone dies, in one continuous mass ; and the disease is then said to be General. This general necrosis varies much in its extent. Sometimes but a slight portion of a long bone so perishes and is thrown off ; sometimes several inches ; sometimes nearly the whole. But it is seldom that the entire bone suffers. Usually the articulating extremities remain ; the line of separation occurring there ; a fact which has been long recognized by the surgeon, and that gladly, as compassing two good ends. First, the process of reproduction or repair is thereby facilitated ; second, the joints are saved from purulent irruption, and from the inflammatory destruction which would necessarily follow.



Fig. 122.

While the cancellous tissue of bone is prone to caries, necrosis is of more frequent occurrence in the dense and compact portions of the skeleton. And this in part accounts for the salutary fact just stated ; namely, that necrosis generally stops at the articulating ends of the bones.

The articulating ends of the long bones are not exempt, however, either from involvement in general necrosis of the shaft, or from the

Fig. 122. Sequestrum ; seen laterally ; the external portion smooth, the internal rough and irregular.

disease occurring in a more limited form within themselves. Examples of the latter affection are not uncommon in the head of the tibia, in young adults—and often attributable to external injury. Death of even a small part of the cancellous tissue there is a formidable disease; by reason of the great risk to which the knee-joint is exposed, of secondary and destructive involvement. Necrosis sometimes also occurs in the articular surfaces of the head of the humerus and femur.

The bones most liable to suffer are those most exposed to atmospheric influence and mechanical violence. The tibia enjoys an unenviable pre-eminence in this respect; next may be ranged the femur, especially at the lower part of its shaft; then the humerus, cranium, lower jaw, clavicle, ulna, etc. The disease, more especially in its acute form, prevails more frequently in the young than in the old. And its causes may be briefly stated to be the same as those of the first stage—ostitis. Of late years, an especial cause has been found to affect the jaws; namely, the vapour generated in the manufacture of lucifer matches. Persons employed in this trade have suffered greatly from necrosis of the upper or lower jaw, sometimes of both; great deformity ensuing, and sometimes even death. The noxious vapour, perhaps, acts in two ways; impairing the general health, as well as directly affecting the periosteum. Its main action, however, seems to be the latter. And, in proof of this, it is observed that only those persons suffer who are affected with loss of substance in the teeth. The disease usually begins with moderate periostitis, which thickens the membrane, and encrusts the jaw with new bony formations. Then suppuration supervenes; the new bone exfoliates, the soft parts slough and ulcerate, and necrosis more or less extensively sets in.

The *Process* of necrosis may be conveniently divided into stages:—1. *The bone, or portion of bone, inflames.* Those cases in which the bone is directly killed by external violence, we have already stated, constitute a minority. In considering the process, therefore, it is right that we describe it as it most frequently occurs; and accordingly we begin with inflammatory access. This may be the result of external injury; as wound, bruise, or fracture; or it may be of apparently spontaneous origin.

In wounds implicating bone, the periosteum is often removed; and this obviously impairs power in the part so stripped, which accordingly, on the supervention of ostitis, is predisposed to die. But it by no means follows that because a portion of bone has been denuded of its periosteum, even rudely, it must inevitably become necrosed. Acute ostitis occurring, necrosis is imminent, but not inevitable; the part may yet retain a sufficiency of power for a successful struggle, and live. But if the periosteum, and the membrane lining the interior—endosteum—both perish, or be removed at corresponding points, death of the portion of bone so isolated, and cut off from its vascular supplies, is then indeed certain.

When exposed bone retains its vitality, it is of a brown hue, sounds dull on being struck, emits blood when rudely handled, and is covered by a self-secreted fluid. On the contrary, if it be dead or dying, its colour is whitish; it is resonant when struck; it is dry, unless when moistened by purulent secretion from the surrounding parts; and it does

not bleed when touched, however rudely. Such signs are useful as not only auxiliary to diagnosis, but bearing strongly on the mode of dressing. However, it must also be well understood that a bone, stripped of periosteum, may at first shew all the usual indications of retained vitality, and yet whiten and die ; and also that an exposed portion of bone may become whitish, sonorous, and apparently non-vascular, shortly after infliction of the injury, and yet recover with the thinnest possible exfoliation. In the latter class of cases, the process of renewed and increased vascularization, in a part previously exsanguine, may often be seen beautifully exemplified.

2. *The bone dies.* The changes just detailed, indicating death of bone, occur sometimes very rapidly, and are completed in a few hours. In other cases, the event may be protracted for several days ; as if life were gradually and reluctantly relinquished. If previously, during the condition of simple osteitis, the periosteum were adherent, it is now completely detached ; and purulent secretion is interposed between it and the bone.

According to the rapidity with which the bone dies, the appearance of the dead part varies. If death be rapid, the bone has had no time to change its structure ; and consequently, as a sequestrum, it retains the character of normal bone. Its external surface is smooth and compact ; and it looks like a portion mechanically removed from a sound skeleton. But if osteitis have existed in the part for some time previous to its death, then its appearance will vary, when dead, according to the duration and intensity of that affection.

3. *The dead portion is separated from the living.* The death, or second stage, is often rapidly completed ; and is never long protracted. This, the third, on the contrary, is invariably tedious and slow. The mode of detachment is similar to that of sloughs in soft texture ; but very different as to the time employed. A slough separates in a few days ; while weeks or months may elapse, and detachment of the sequestrum may still be incomplete.

The extent of the necrosed portion is indicated by its white, sonorous, insensible, and non-vascular characters ; and these it retains throughout the whole process ; seeming as if it were a macerated portion of skeleton. The only change likely to occur is a darkening of its hue, by exposure to atmospheric influence when superficial, or to chemical action from contact with purulent secretion. But around this unchanging dead portion, and more especially in the parts immediately continuous, there is great activity. The colour is red or dark brown ; evidently from increased and increasing vascularity. The slightest touch is painful, and followed by blood, of a florid arterial hue ; and the probe or finger plainly indicates a softening of that part, through removal of a large proportion of its earthy matter. In short, while the dead part is undergoing little or no change, unless perhaps a variation of hue, the living parts all around are busy carrying on an inflammatory process of a degenerative kind. The first change observable in the process of separation is, that the living bone along the line of junction with the dead has its periosteum thickened. If we strip this off at the margin, we see that the vessels entering the Haversian canals come out, not as mere threads,

but as plug-like masses of granulation ; leaving behind a pit-like depression or fovea. By a gradual transformation of the living osseous substance along the line of junction of the dead with the living, into a similar soft granulation-material, the line of separation becomes a continuous trench. This goes on deepening ; and the soft substance which occupies its hollow, while firmly connected with the living bone, has no further connection with the dead than mere juxtaposition. " The whole process of separation is a degenerative osteitis, in which the osseous tissue changes its character ; losing its chemical and morphological characters, it becomes converted into a soft tissue, which no longer contains bone."



Fig. 123.



Fig. 124.

As in the similar process in soft parts, separation of the dead from the living does not proceed alone. Reparation follows quickly on its heel. And no sooner has the primitive sulcus been formed by the work of degenerative change, than granulation-tissue begins to spread, from the periosteal margin, where it remained attached to the bone, along the visceral aspect of the periosteum which had separated from the dead portion. Here the proliferation of the cell structures gives rise to the formation of a granulation-material which is rich in cells, more especially young cells ; and in this respect, as well as in the absence of all fatty degeneration, it is distinguished from the soft substance into which the osseous elements were transformed along the line of separation from the dead bone. These granulations do not, however, continue long as such. As the osseous-tissue becomes converted into granulation-tissue, so the granulation-tissue formed from the osseous elements attached to the periosteum becomes transformed into bone ; ready in some degree to occupy the place of the dead portion when separation is completed. The stage of separation commenced immediately on the completion of that of death ; and the former was not well begun, ere the work of reproduction had laid its own foundation.

Separation, it has been stated, is invariably slow ; and it is well that it is so. For the formation of new bone, to supply the place of the old which has perished and must be thrown away, is also a process inevitably tedious, even although early begun. The two—separation of the old, and production of the new—advance together ; and it is surely a most beneficial and wise arrangement, which has decreed that the one shall

Fig. 123. Necrosis of the femur, after amputation. At *a*, the sequestrum in process of separation. At *b*, the parent bone enlarged, and undergoing inflammatory change, necessary for detachment and repair.

Fig. 124. The sequestrum detached ; at its lowest part, *a*, including the whole thickness of the bone. Gradually shelving upwards, as such sequestra usually do.

not be completed leaving the other much imperfect ; that the portion of old bone shall not be loosened, and cast away as a useless thing, until an efficient substitute has been prepared to occupy its place and function.

During the process of separation, by ulceration, there is necessarily a constant, and often a profuse secretion of pus. This is discharged externally, through apertures in the soft parts already existing ; or it burrows and accumulates at new points, where free and dependent incision soon comes to be demanded. The discharge is usually thick, and yellow ; laudable in appearance ; charged with more or less of the ulcerated debris ; and invariably possessed of an oppressive and peculiar factor—a sickening heavy odour, which, when once perceived, will ever after be readily recognized—a sure sign of bone disease. When analysed, the discharge is found to contain an unusually large proportion of earthy matter ; doubtless the results of the vital changes by which the formerly dense hard osseous tissue is transformed into granulation material and pus cells.

Sometimes a pulsating movement is observable in the part, during the progress of separation ; owing, probably, to the increased vascular function so busy in the process.

4. *Separation of the dead portion is completed.* The cell transformation, just described, has encompassed it on all sides and beneath. It is now loose ; unless where hemmed in by exuberant formation of new osseous matter above and around, as is not unfrequently the case—a redundancy of reparative effort by no means to be complained of, being obviously by much the safer side on which Nature may err. The sequestrum is now to all intents and purposes a foreign substance ; detached from the living ; of no further use, and no longer recognized as a part of the living economy ; on the contrary, a noxious body whose presence is resented by continual suppuration and excitement in the living parts, and which cannot be too soon cast away.

Sometimes the death and separation are not continuous, in mass ; but in small successive portions, many or most of which may be so minute as to escape observation. A superficial portion of bone, of considerable extent, is denuded by a suppurative process ; but, instead of a like-sized exfoliation separating in the usual way, it gradually becomes covered in by granulation. It seems to have been absorbed. But, in truth, while some portion of it may have come away in small thin flakes, or in still more minute particles, by a so-called process of "*Insensible Exfoliation*," the greater part has retained its vitality, and either granulated by change in the osseous elements on its surface, or become again adherent to the periosteum by which it was originally covered.

5. *The dead portion is extruded.* As in the threatened lodgment of any other foreign substance, suppuration is the main agent here. By pus a loose sequestrum is, as it were, floated to the surface, and there exposed. And if surgery be either slothful, or altogether in abeyance, Nature may even complete the task of final discharge ; though slowly and painfully, and with much exhaustion to the general frame. But another agent is also at work. By the ancients it was supposed, that the dead portion was simply pushed off by granulation from beneath ; ere yet it was detached from its continuity with the living texture. Such we have seen

is not the case. It is first separated by a very opposite process ; not formation of new matter, but transformation of the old. But to this transformation of the old, as a means of separation, formation of new as a means of reparation almost immediately succeeds. And this work of repair is not limited to the margins of the sulcus, but follows the line of separation throughout its whole track. So that, when the dead part is completely detached and loose, it is virtually borne on a bed of granulation ; which, continuing to enlarge upwards, in the reproductive effort, obviously assists in carrying outwards the sequestrum and favouring its approach to the surface. At the same time, be it ever remembered, this and every other effort towards expulsion may be fully counteracted, by retention of the dead and detached part in a tight embrace of the living substitute, which has formed over and partially incased it.

And in another way spontaneous extrusion may be prevented ; the sequestrum seeming to be attached, while truly separate. The same granulations, not yet ossifying, may interlace themselves through the irregular and often cribriform margins of the dead part ; as creeping plants twine through trellis-work.

By some this irregular and cribriform appearance, so commonly observed, has been accounted for by supposing that the corresponding granulations have by their absorptive powers consumed the bone, and made the perforations and spaces. But it is more rational to conclude that these are the result of bone having died irregularly, instead of with a bluff clear line ; that they have been formed by the degenerative transformation of the living bone at these points, during the general process of separation ; and that, in the third place, as to time—not in the first—the granulations have shot up from, and corresponding to, the outline of the living bone along the margin of the spaces and perforations which exist in the dead.

It is supposed that occasionally the process of separation is somehow arrested, and may remain for years incomplete. No doubt sequestra have been found undetached, many years after injury done to the part. But proof is wanting to shew that necrosis was coeval with the injury. More probably, in such cases, the formation of the sequestrum resulted from a later osteitis ; and its separation was truly progressing in the ordinary way.

The sequestrum is always less than the space left on separation, as can readily be understood ; allowance being made for amplification of the latter, by the transformation of more or less of the living bone into soft texture, whereby separation is effected.

6. *Reparation is completed.* This, we have already seen, begins at the same time as the process of separation ; and is originated by the old bone, at the living margin of the ulcerative sulcus. From this point it advances, consentaneously with the process of separation ; in two parts, a deep and superficial. The former, following close in the track of the line of separation, consists of osseous production from the living bone beneath the loosening sequestrum. The other, begun by bone, and carried on by periosteum—a membrane invested with great and special ossific power*—invests the dead part on its exterior ; gradually shelving

* Periosteum, under such circumstances, does not consist merely of fibrous tissue,

over and encrusting it, as bark does a tree ; and hence often termed the *Cortical* portion of the *Substitute*, or new formation.

Wherever the periosteum is entire, there the formation of this cortical bone proceeds, continuously with that which was begun by the parent shaft. But in several places, it is probable that periosteum is deficient. So soon as the part died, its periosteum became detached from it ; and pus was interposed. This pus must, sooner or later, find its way to the surface. And, for this purpose, solution of continuity is



Fig. 125.



Fig. 126.



Fig. 127.

made in the investing membrane ; either by the knife or by ulceration, more frequently by the latter. Such apertures remain open, not unfrequently widen, and through them pus continues to be discharged. The cortical formation, probably begun by bone, but maintained—nay, chiefly effected—by periosteum, having reached such an aperture, has its continuity interrupted. Where the membrane is deficient, so is the osseous shell ; and an aperture is formed in the newly constructed case of bone,

with blood-vessels and nerves ; but also contains more or less of the osseous elementary structures along the vessels which have been separated with it from the Haversian canals, as also fragments of living bone, and of granulation-material due to the softening of the osseous tissue.

Fig. 125. Acute necrosis of the tibia. The bone extensively perished at *a* ; the cortical formation has begun to form. Fibula, as usual, unaffected.

Fig. 126. Necrosis of tibia ; more advanced. Cortical formation investing the greater part of the old bone.

Fig. 127. Necrosis of tibia ; in the chronic stage. Cortical, or substitute bone, complete, and consolidated. At several points cloacæ seen, leading down to the sequestra.

corresponding to the opening in the periosteum. In fracture, without suppuration, ossification is begun by bone, is continued by periosteum, and where that is deficient is sustained by the surrounding parts, the connective tissue of which assumes periosteal character and function; and consequently the incasement of bone, under such circumstances, is continuous. But here there is no substitute for deficient periosteum; the surrounding soft parts have suppurated, and are themselves reduced to the condition of an aperture or canal for the discharge of matter.

This, however, is not a disadvantage. On the contrary, were deficiencies of periosteum invariably supplied by adventitious structure of similar capabilities, the cortical formation would also invariably be continuous; purulent matter would be denied an outlet; and all the pains and dangers of acutely accumulating, and deeply-seated pus, would inevitably ensue. As it is, deficiency of periosteum is not supplied; and the cortical formation is at that point proportionally defective. A permanent aperture, termed *Cloaca*, results (Fig. 127); which communicates internally with the cavity which contains the sequestrum, and opens into the suppurated canal of the soft parts exteriorly, so proving of the greatest use in securing efficient discharge of purulent or other fluids.

The external orifice of this discharging canal is usually callous, and of an elevated or pouting character. It is termed a *Papilla*; and in every case where necrosis is at all extensive, there are not one but several such purulent canals; through the cloacæ in connection with which, a probe may be made to impinge on the sequestrum. The position of these apertures, externally, in necrosis of the shafts of long bones, serves frequently, when several exist, to indicate the extent of the sequestrum; the most dependent being beyond the lower end of the sequestrum, the upper always a little below the upper extremity.

Through these apertures, the condition of the dead portion may be from time to time ascertained; and so soon as it has become loose, it is through these apertures, enlarged if need be, that it is removed. When it has been discharged, the two portions of the new osseous formation coalesce; and so complete the construction of the dead bone's substitute. Hitherto the sequestrum, as a foreign substance, was interposed between; now the cortical frame, descending, comes ultimately to mingle the soft osseous granules of its internal aspect with those which are rising from the subjacent stratum of original bone. And so, somewhat as in chasm of the soft parts, the cavity, previously occupied by the sequestrum, is filled up; partly by continued formation of new matter, partly by mutual approach of the parts already formed. Suppuration ceases gradually; the cloacæ, no longer useful, may slowly diminish, or even fill up—by new formation from their osseous margins, or by contraction of the cortical shell; the whole part becomes firmly consolidated; and the inflam-



Fig. 128.

Fig. 128. Necrosis of tibia. At *a*, the dead bone exposed. At *b, b*, the papillæ represented, communicating through cloacæ with the sequestrum.

matory process altogether subsides. Should the cloacæ remain unclosed, the soft parts may notwithstanding heal kindly over them ; provided there be no dead bone remaining, to keep up purulent discharge.

Before removal of the dead part, there was much bulky swelling of the limb ; partly from the infiltrated condition of the soft parts, partly from the elevated position of the cortical bone. But now this latter seeks a lower level. Besides, the continuous chronic irritation so acts as to condense and strengthen the new texture ; rendering it more efficient as part of a column of support. And, at the same time, the inflammatory process having in all its grades and everywhere abated, absorption is not idle in the superimposed soft textures. In consequence, the unseemly swelling gradually disappears ; and, ultimately, the part has both its function and its symmetry more or less completely restored.

Hitherto, we have been speaking of the restorative process as occurring in a case of partial necrosis ; an external portion only having perished ; living bone on one side, and periosteum on the other. Events are very similar in the other forms of the disease. When the necrosis is Internal, a part of the cancellous texture only having died, reparation follows rapidly on extrusion of the sequestrum. This takes place through an aperture, formed by ulceration, in the laminated portion ; which opening, like the corresponding interruption of continuity in cortical formation, is termed a cloaca. And when through this, whether by nature or by art, extrusion has been effected, reproduction is accomplished entirely by the surrounding living bone, which constitutes the parietes of the cavity in which the sequestrum lodged. At first, the new structure is of preternatural density ; but by the continued work of absorption, the normal characters of the bone are ultimately restored.

When the internal sequestrum is small, the original inflammatory affection having been but limited, and the present suppuration being but slow and slight, ulcerative perforation of the bone for discharge of both pus and sequestrum may be a very tedious process. Meanwhile, by continued presence of the foreign body within, osteitis of a minor grade is permanently maintained in the vicinity, and perhaps to a wide extent. In consequence, the bone may become much enlarged, as well as condensed in its structure ; and often is roughly nodulated on the exterior. A somewhat similar change in the shaft of a long bone also follows the formation and lodgment of a large internal sequestrum ; in connection with which a cloaca may have been early formed, but too minute to admit of spontaneous extrusion.

When a portion of bone including its whole thickness has perished, the process of separation advances in the usual way ; as also the commencement of reparation, by osseous production from the living margins of the sulcus. As usual, this osseous production, begun by the bone, is continued by the periosteum ; shelving over the exterior of the dead part. The sequestrum, when loose, is dislodged from its continuous relation to the living shaft ; and this dislocation may perhaps be the work of surrounding osseous granulations. It then gradually seeks the surface. And thus both room and opportunity are afforded for the parent bone, on each mutilated aspect, to send forth its reproductive formation ; sometimes not very vigorously or copiously furnished, and always in a shelving

or conical form. If successful, the apices of the new, coming from either end of the old bone, meet and coalesce; and then this *pith* part of the substitute may attain to considerable bulk. After extrusion of the sequestrum, the new cortical portion falls inwards, as usual; and, combining with the central *pith*, a solid and efficient substitute is ultimately obtained.

Complete reproduction, however, is not to be expected in all cases. If a small portion only of the entire thickness perish—say half an inch, or an inch—doubtless it will be ultimately though slowly reproduced. The parts are equal to the task required of them. The bone, more especially, is quite able to overtake its part of the duty; the osseous formation, from either end, uniting to form a dense and compact reunion of the central portions of the shaft.

In all cases, the periosteum, when left entire, is capable of executing its share; namely, formation of the cortical portion. But that is not enough. The cortical portion, if left to itself, after extrusion of the sequestrum, unsupported by an interior production from the bone, may shrivel and bend, prove altogether insufficient as a column of support, and ultimately be in a great measure removed by absorption. The two portions of bone will shoot out new matter, readily, so as to effect union by restoration to the extent of an inch or two. But in seeking to traverse a greater space, that portion of the reparative effort is likely to flag and fail. The new cones do not coalesce; but taper finely off, each ending in a point coherent with the condensed soft tissues around. And therefore, practically, it must be remembered, that when a sequestrum has come away, including almost the entire shaft of a long bone, reproduction can scarcely be expected to prove complete; for as such reproduction must be looked for almost entirely at the hands of the periosteum, when the entire shaft perishes, there can be but little of the essential osseous elements left attached to it from which the process of reproduction can occur. It is astonishing, however, how successful the restorative effort sometimes proves, even in circumstances by no means auspicious. In not a few instances, long bones have been almost wholly reproduced. And, therefore, in necrosis of the entire thickness of the shaft, even of great extent, a chance of cure in the ordinary way ought invariably to be afforded; taking special care, throughout the whole period of treatment, to keep the periosteum as entire as possible; and not to remove the dead shaft too soon, even if separation at its junction with the epiphysis has become complete, lest by so doing the collapse of the as yet but slightly ossified granulating surface should produce a diminutive substitute, quite insufficient for the functions of the limb. The short bones, if wholly necrosed, are never reproduced. And reproduction is also rare in the flat bones; especially the cranium.

Also, let it be borne in mind, that for suitable reproduction, under any circumstances, it is essential that the inflammatory process shall subside from its higher grades; otherwise, the product will consist of the destructive results of this process. In practice, indeed, our principal care is directed to ward off acute inflammatory reaccession; knowing well that should this occur, repair will be interrupted; the cure will be at least delayed, and perhaps rendered wholly abortive.

Such is necrosis. It may be partial and External. Then the sequestrum has its peculiar characters. As formerly stated, the doomed portion usually parts rapidly with vitality, at an early period of the disorder; ere it has time to undergo change. And, accordingly, it presents, on its removal, the usual appearances of the external, dense, laminated texture of bone; as if it were part of a macerated skeleton. But it is rough and irregular at its lower and lateral aspects; where, by the process of degenerative transformation into a soft granulation-tissue in the surrounding bone, it has been slowly and unequally separated from the living part.

Or necrosis may be partial and Internal. Then the sequestrum is very distinctive of its original site; being not only open as ordinary cancellous texture, but also rough and scabrous at every point; shewing no surface of a smooth and laminated character—unless it be the comparatively smooth internal surface of the medullary canal.

Or the entire thickness is included; the sequestrum consisting of a portion of the bone which is rough and irregular at either extremity; but in other respects seeming as if artificially removed from the skeleton. And thus, according to its situation and extent, a sequestrum, like its parent osteitis, is termed Internal, External, or General.

Symptoms.—The symptoms of necrosis are, at first, those of acute osteitis. Suppuration having occurred, these are aggravated; no relief following the suppurative crisis, as sometimes happens in the soft tissues; for here the first investment of the pus is invariably dense and unyielding. But relief comes with evacuation of the matter; whether effected by nature or by art. By the former, the process is tedious, and abatement of the symptoms proportionally slow; by the latter, if early and efficiently adopted, relief is both instant and great. All the surrounding soft parts are very much involved, from the beginning: at first consolidated, as well as thickened and enlarged; afterwards the seat of suppuration, more or less extensive, sometimes diffuse, more frequently limited by fibrinous condensation.

The matter is discharged, usually, through several apertures; the number generally bearing a proportion to the extent of the disease. Through the papillæ and cloacæ the presence of the dead portion of bone is detected; and its condition as to detachment may be from time to time ascertained, by the use of a probe—or, what is better, by introducing the finger, should space permit. When the sequestrum is internal, it is felt rough, yet dense; when external, it is felt smooth and solid, except at the circumference, where, by the sulcus of separation, the bone has been rendered rough and irregular.

During the stage of separation, and the concomitant one of reparation, discharge is continued; usually copious; and invariably foetid, as before stated. In consequence of such discharge, the constitutional symptoms which during the osteitis, both simple and suppurative, may have shewn all the characters of acute inflammatory fever, often intense, may change now into hectic. Or, in strong systems, almost all trace of febrile disturbance may pass away.

But the local inflammatory process has not yet subsided. So long as the foreign body—as the sequestrum truly is—remains unextruded,

the living parts will continue to resent its presence. So much of the inflammatory process is sustained in its immediate vicinity, as is essential towards the work of separation; while a minor grade of the process continues to pervade the whole neighbouring parts. The substitute bone is busily advancing; in the soft parts, plastic product is still in the ascendant, and absorption is doing but little towards remodelling the limb. Besides, the soft parts become increased in vascularity, sometimes to a very considerable degree; so that when incised—and they cut like a piece of gristle, rather than ordinary soft textures—hemorrhage is invariably profuse; not only because the vessels are both active and numerous, but also in consequence of natural hemostatics being opposed by the dense structural change in which the vessels are imbedded.

Should inflammatory reaccession occur, the symptoms may all be renewed with their pristine severity. And if the newly-formed pus be so situated as not to find a ready exit, it is not improbable that serious extension of the original necrosis may ensue. Thus it may happen that necrosis, at first limited to but a small part of laminated texture, may ultimately involve, not only the whole thickness, but almost the whole extent of a bone.

When the sequestrum has become wholly detached from the living bone, it does not always seem loose. For it may, at more than one point, be bound down by the tight embrace of the new cortical formation; or, as already mentioned, newly-formed texture—granulation-tissue may—be interwoven with its cribriform parts. Or new bone may be deposited, in points or patches, so closely on the dead part's surface, as actually to re-establish their continuity. Or new bone, like the softer textures, may interlace the cribriform spaces of the sequestrum. Generally, however, so soon as detachment is complete, the sequestrum is more or less movable; as the finger or probe will testify. And if not then artificially removed—as it should be—it will spontaneously seek the surface, and project there—provided there be space left for its exit through the cortical formation; the protruded portion becoming blackened, apparently through atmospheric influence. As a general rule, it may be safely held that a dead portion of bone, which is protruding through an external opening in the soft parts, has been completely loosened from its connection with the living bone; and that if it seem fixed, it can only be on account of secondary retention in one or other of the ways just mentioned—most probably by cortical embrace.

Sometimes the substitute itself perishes, by inflammatory accession; a result not at all improbable, when we consider how active the nutritive processes have been in determining the different changes through which it has passed within a recent period. And this affords another reason, why such inflammatory reaccession should be anxiously provided against, throughout the whole period of repair. Should the superimposed soft parts happen to become the seat of hospital-sore, the substitute cannot fail to be more or less exposed and involved; and may consequently die and come away, in whole or in part.

The time occupied by the various changes is extremely various. In acute external necrosis, of very limited extent, as in the phalanges of the fingers, many days may not elapse between the first onset of the inflam-

matory process and final extrusion of the small sequestrum. In more extensive examples, by weeks or months we will prove more ready reckoners of the time. When the whole thickness of a bone has perished, to some considerable extent, many months may be, and usually are, consumed, ere the bone has been got away ; and at least an equal term may be required ere, subsequently to that event, the limb resumes even an approach to its pristine form and function. In the young and otherwise healthy, progress will be more rapid than in the aged and infirm ; and much will also depend upon treatment. If inflammatory re-accessions have been either directly induced, or not sufficiently provided against, the term of cure may be protracted almost indefinitely. In spongy bones too, the process is ordinarily more rapid than in dense ; the former being more vascular, and better capable of energetic effort. Also the bones of the superior extremity have an advantage, in this respect, over those of the lower.

Treatment.—Again, prevention is to be considered paramount. Treat the preliminary ostitis, with energy yet warily ; in order that it may be arrested in its progress, ere any destructive result has yet begun. When suppuration has taken place, and the doomed portion or portions of bone are dead or dying, our object is a minor one ; to mitigate symptoms, prevent extension of evil already incurred, and favour the advancement of repair. The first, and not the least important indication to be fulfilled, is early and efficient evacuation of the purulent formation which bathes the inflamed bone, and has detached it from its periosteum. Some considerable time must be unprofitably consumed, ere pus can work out its own discharge, through the periosteum and other unfavourably investing tissues ; meanwhile the patient's sufferings will have been great, and aggravation of the original evil not inconsiderable. Time, texture, and torture may be all saved, by an early, free, and direct incision ; which, accordingly, should invariably be practised, so soon as the indications of suppuration are sufficiently manifest.

Detachment of the sequestrum we commit entirely to Nature ; contenting ourselves with overlooking her operation ; and taking especial care that she shall not be interrupted. With this latter object in view, the part is kept quiet, used as little as possible, and not put in the way of external violence. By some, exercise of the affected part is enjoined, with a view to expedite separation of the dead portion, when that seems to be unreasonably slow. But the practice seems fraught with danger, as regards the risk of fracture, deformity, or at least aggravation and extension of the disease, by inducing inflammatory reaccession. Should this at any time threaten, leeches, fomentation, absolute repose, and general antiphlogistics if need be, are at once employed with a view to its speedy arrest. On this account also, during the chronic stage, when perhaps purulent secretion is great, and hectic is either threatened or fully developed, and when consequently we are anxious to support the system in its difficulties—that support must be prudently conducted, and made to vary from time to time, as circumstances may demand.

When the sequestrum has become wholly detached from the living bone, by completion of the sulcus in the margin of the latter, Nature's exclusive work is over ; and it is then usually our cue to interfere.

Nature's power of detachment is adequate and admirable, but her power of extrusion is weak and imperfect ; and the surgeon, who deliberately imposes on her the latter effort, is both negligent and unskilful. She may, and often does accomplish the task ; but only after much suffering by the patient, and exhaustion of his frame ; and not until much structural change, perhaps irremediable, has occurred in the part—all unnecessary, and, by the judicious assistance of the surgeon, timeously afforded, capable of being altogether prevented. Very pretty preparations are to be found in most pathological collections, which should never have graced their shelves ; sequestra, quite loose, but cooped up within dense and thick new bone—the cause of long continued suppuration, growing hectic, and ultimate amputation of the limb. Long before that last event, they should have been cut down upon, taken away ; the preparation lost, the limb saved.

But perhaps a more common error in practical surgery is, interference with the sequestrum before it has become loose. To lay hold of it then, and use violence, after exposure by incision, is certainly to induce a combination of evils. The evulsive effort fails ; and, consequently, the patient has been put to pain unnecessarily and fruitlessly. By the violence, a fresh ostitis, probably both acute and extensive, is induced ; and aggravation of the necrosis is most likely to follow. Also, the loss of blood which attends on such an attempt, is invariably considerable ; coming from a wound of soft parts, which are not only unusually vascular, but, besides, unfavourable to natural hemostatics, as formerly explained. And the patient's state of system is generally such, in the advanced stage of necrosis, as to be intolerant of a repetition of such hemorrhages. Therefore, on this last ground alone, it is plain that the operation for removal of a sequestrum should never be undertaken, especially when it is situated in close proximity to a large joint, unless the surgeon be tolerably certain that his effort will then prove successful.

During the whole stage of separation between the dead and living bone, the wise surgeon is little more than an interested on-looker ; prepared to ward off inflammatory re-accession by suitable antiphlogistics, should that threaten to occur ; and careful to limit motion, in order to avert fracture or bending of the changing member. From time to time, he may, by his finger or probe, ascertain the rate and extent of progress ; yet using all most gently. Every rudeness of examination must be carefully eschewed ; as being prone not only to interrupt formation of the substitute, but also to extend anew the limits of the disease.

In probing, the simultaneous use of two instruments is sometimes advantageous. One probe resting on the end of the sequestrum, a second is introduced through another cloaca ; and by pressing with each alternately, looseness of the sequestrum may be made plain, in circumstances otherwise extremely doubtful.

So soon as the sequestrum has become loose, the necessary steps are taken for its removal. An incision is made through the superimposed soft parts ; neither too free, causing unnecessary loss of blood ; nor too limited, obstructing the subsequent procedure by want of space. In making the incision, the best point for attack is about the middle of the sequestrum. Through the cloaca or cloacæ, the extent and form of the

dead portion or portions are then ascertained ; and if the natural opening afford space enough, through this forceps are introduced, and the sequestrum seized and extracted. It usually happens, however, that the natural openings are not sufficient ; the sequestrum proving large, and having become on all sides invested by stout cortical formation. It may be necessary, therefore, either to divide the sequestrum in the middle, and extract it in two or more pieces, or to convert two cloacæ into one, by the saw or cutting pliers. Or one cloaca, whether in old or new bone, may be enlarged to the required extent, by the cutting pliers, or more suitably, in most cases, by the trephine. In all cases, however, let as little of the new bone be sacrificed as possible. For, once removed, it will be but sparingly reproduced ; and the limb, in consequence, may be permanently and unsafely weakened, as well as deformed.

The sequestrum having been duly exposed, the laying hold of it comes to be of some consequence. Forceps are the best adapted instrument ; but, in general, they are used much too small and feeble. The common dressing forceps, as found in the ordinary pocket case, are quite unsuitable ; except for very small sequestra, wholly unconfined by cortical formation. Strong blunt pliers, made for the purpose, should be em-

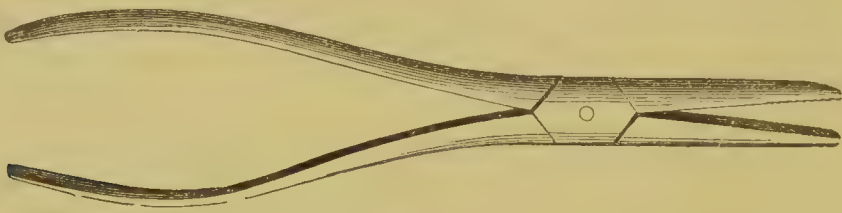


Fig. 129.

ployed ; like bell-hanger's pliers, only longer in both blade and handle, with the former well serrated to prove surely prehensile, and powerful in every part. By means of these the dead portion is firmly grasped, and moved to and fro, so as to ensure its freedom from the surrounding substitute. Then, by a steady pull, it is brought to the surface ; leverage power being used, if need be, to break up any further obstacle which may obstruct its final removal. Such determined procedure saves pain, time, blood, and trouble. For the smaller and weaker instrument is prone to slip ; only after repeated efforts is anything like a secure hold obtained by it ; and thus often much wriggling and real force are required, to overcome unexpected obstacles by unequal means. When the sequestrum is long, and the main aperture leads to its middle rather than to either extremity, extraction, as we have said, is often much facilitated by cutting through its centre with the bone pliers, and then extracting each portion separately. In other cases, again, when the whole thickness of the bone, and a considerable extent of its shaft, are involved, operative interference may very generally be delayed for some time after separation has become complete, until we ascertain that the substitute bone has been formed to such an extent as to prevent the risk of collapse of the thickened periosteum.

Thus, then, the errors most likely to occur, in the manual treatment of necrosis, are these :—too early an interference, ere the natural process

Fig. 129. Forceps suitable for removing sequestra.

of separation has been accomplished, or ere the substitute bone has become sufficiently developed; attempted removal of the dead portion, when loose, by inadequate means; and the leaving of it undisturbed, when loose, throwing on Nature the labour of extrusion as well as of separation. That the last is an undoubted error is very plain, when we consider that the sequestrum, when loose, is to all intents and purposes a foreign body, and as such will be regarded by the living parts; creating much local disturbance, as well as serious inroad on the constitutional powers; both unnecessary.

By some it has been urged, in defence, or at least in palliation of the indolent system of treatment, that there is a possibility of the dead portion disappearing; in one of two ways—either by absorption, or by solution in the purulent fluid in which it is soaked. That such hope is altogether futile, from either of these events, has been abundantly proved. A portion of bone, detached from the living, is plainly not amenable to absorption; unless, by solution, it be presented for absorption in a fluid form. And direct experiments, more especially those of Mr. Gulliver,* have shewn, that dead portions of bone are wholly insoluble in the purulent or other fluids, to which in a living part they may be exposed. A portion of bone adjoining a sequestrum may be partially absorbed, or molecularly disintegrated; but dead bone itself is liable to neither absorption nor disintegration, nor to any vital process. Because a large cavity is found in the interior of a bone, either altogether empty, or containing but a few minute sequestra, we are not thence to infer that the cancellous texture, originally occupying this space, has first necrosed and then been absorbed. It has parted with its vitality doubtless; not, however, in a continuous mass, but in molecules; not by necrosis, but by caries. And though the dead portions have been removed, they have not been taken back into the system, but thrown out through the external opening.

At one time it was proposed to apply nitrous or other acids to the sequestrum, with a view to its becoming pliable through loss of its earthy matter, and so capable of being gently pulled away, at the cost of but little pain or blood. The impossibility of confining the acid's action to the part to be destroyed, is an insuperable objection to the practice.

When the sequestrum has been removed by operation, the wound is stuffed moderately with dry lint; partly to arrest the bleeding, partly to ensure the wound's ultimate closure by a gradual filling up from the bottom. The antiphlogistic regimen is maintained for some days; as a certain amount of inflammatory accession is an inevitable result of the interference, however gently and skilfully conducted; and it being evidently of much importance to keep such affection within moderate limits. Otherwise, the act of removing one dead portion of bone might become the means of inducing the formation of a second sequestrum, perhaps more extensive. The limb is kept quiet, free from motion and the support of weight; for, as yet, the substitute is hollow, imperfect, consequently weak, and prone on the application of either motion or weight to give way by fracture or bending. Not till some considerable time has

* *Medico-Chirurgical Transactions*, vol. xxi. London, 1838.

elapsed—varying in different cases, according to the circumstances of each—does consolidation of the substitute occur; sufficient to restore not only the appearance, but the function of the bone affected. Not until then, should the patient be permitted to employ the limb with any degree of freedom. And, indeed, in many cases, in which temporary weakness of the new formation is peculiarly manifest, it is well not to leave immunity from function at the discretion of the patient; but to insure this, and at the same time afford an adventitious support from without, by incasing the affected portion of the limb in splints and bandaging. As already stated, similar care is not unfrequently demanded during the latter part of the stage of separation; for then, also, the bone is weak, and prone on exertion either to bend or break. At neither period, however, let the limb be kept constantly rigid and unmoved. From time to time, let the articulations be supplied by gentle and passive motion; otherwise, stiffness, or even actual change of structure by disease, may be induced.

Superficial exfoliation may sometimes be hastened. But this is only an exception to the general rule, of non-interference previous to the completion of detachment. When a thin shell of bone, for example, is coming slowly away from the calvarium, it may sometimes be expedited by applying an escharotic, such as the chloride of zinc; taking care that the application is limited to the dead portion, and its very immediate vicinity.

Again, after detachment has been completed, a superficial exfoliation of the skull may seem fixed. It cannot be by cortical formation; for, in the cranium, this is seldom if ever produced. It may be the result either of redundant granulation, or of atmospheric pressure. Granulations may have sprung up from the surrounding parts, both hard and soft, but especially from the latter, to such an extent as to partially overlay the dead portion of bone; confining it to its place, even though wholly freed from attachment beneath. In such a case, the redundant soft parts are to be freely pushed aside, by the knife or probe; and the bone, thus liberated, is then removed. Atmospheric pressure, when the cause of undue retention, may be overcome, by fixing a screw in the dead part, and thereby elevating one portion so as to admit the air beneath; then it is loosened in every way, and can be readily lifted from its place.

Amputation is sometimes demanded, though rarely, in necrosis. It is the exception, not the rule. It may happen that in acute necrosis of the young, violent inflammatory is followed by severe irritative fever; and that both are quickly succeeded by a formidable hectic, which must plainly be relieved, at all hazards, by removal of its cause. Under such circumstances, it may become not only expedient, but imperative, to take off the limb; perhaps very shortly after the first accession of the disease; while the recently dead bone is yet freshly bathed in pus, and when the process of separation has but just begun. Or, in the more chronic cases, a like summary procedure may be required at a far more distant date; after not only weeks but months have elapsed; when the separation has become far advanced, but is not yet complete; after the system has long borne up nobly, under the exhausting burden of irritation and discharge;

but when, nevertheless, it has evidently become unequal to a prolongation of the contest. Such cases, however, constitute but a small minority. The greater number are prosperous in their issue ; if duly conducted. The system, which has borne up long, is enabled to sustain its task till the end ; the dead part is separated and discharged ; the substitute condenses and solidifies ; the swelling of the soft parts subsides ; purulent formation diminishes, and the apertures in both hard and soft parts are closed ; the limb is not only saved, but is as useful as before.

On the one hand, we must beware of sacrificing life, in vain endeavour to save a limb ; and on the other, we must be equally careful not to sacrifice a limb, in our anxiety to succour life not yet brought into actual danger ; a dilemma in practice, from whose horns we can extricate ourselves, only by a happy combination of knowledge, judgment, and experience. And, in relation to this subject, it is important to remember, that necrosis is not always as extensive as it outwardly seems. Discharge may be copious, fistulæ numerous, soft parts extensively involved, and constitutional disturbance great ; and still the sequestrum may be of but limited extent, both in surface and in depth.

Recourse to amputation may also be advisable, in the case of extensive death of a bone throughout its whole thickness, when the expected reproduction has failed. The limb then bends, shrivels, and is worse than useless ; its removal becoming a matter of expediency, in the eyes of both patient and practitioner.

In consequence of neglect, a limb may be presented to us much bent, and otherwise deformed ; with a large blackened sequestrum, partially protruded from the surface. The appearance may be altogether so unpromising, as to lead a hasty and inexperienced observer at once to advise amputation. But this is never warrantable, under even such circumstances, unless the system be already sunk very low, and plainly unable to bear a prolongation of the strain. Then we amputate to save life ; but in the majority of even such examples, we ought to save both life and limb. The sequestrum is removed, with an expenditure of as little blood as possible ; the limb is laid in splints ; the bending is gradually undone, by bandaging ; by suitable diet and medicine, constitutional power is maintained ; and thorough restoration of the limb may be ultimately obtained.

FRAGILITAS OSSIUM.

Bones are liable to become brittle, by reason of change in their structure. By some this has been attributed to the absence of fluoric acid as a constituent of the skeleton ; permitting the phosphate of lime to assume the crystalline form, and so rendering the bone affected more liable to fracture. Be this as it may, in all such cases oily matter exists in unusual quantity ; the osseous texture is lighter and more spongy than in the normal state ; and by interstitial absorption the external laminated portion has been diminished by conversion into medullary tissue. In truth the bone may be said to consist of cancellous texture, filled with an oily substance, and surrounded externally by a thin brittle lamella.

This change may be regarded as constituting a distinct and special disease of itself (*Mollities ossium*); or only as a result of other diseases—and these various. It results from old standing chronic rheumatism, and from long confinement to bed, with inactivity of the extremities, from any cause. It is one of the many decays to which the frame is liable in consequence of the intemperate and long sustained use of alcohols; and is specially apt to occur if the individual happen to be bedridden. It frequently complicates cancerous disease of the soft parts. It is no uncommon attendant on the cachexy which results—more especially in those of advanced life—from the sinister combination of mercurial and syphilitic influences. Scurvy, too, may cause it. And the soft and rickety bone, is very susceptible of fracture.

The exciting cause of fracture need be but a slight one. A hasty or inadvertent step, turning in bed, rising from the seat or from the knees, a trip on the carpet, or any sudden muscular exertion, may suffice.

Treatment.—All that can be done, in prophylaxis, is to guard against the occurrence of exciting causes; and, at the same time, we may endeavour to prevent increase of the cachectic state, by such hygienic and therapeutic treatment of the system as circumstances may seem to require.

When fracture has occurred, the part is to be arranged carefully, as in ordinary cases of that accident. It may be that re-union may not occur. And it is more than probable that, when it does take place, the process will prove very tedious, and the result imperfect. A second or third fracture may happen, during the treatment of the first (no less than 22 fractures occurred in a case of Tyrell's, and 31 in a case of Arnott's); the constitution may suffer and sink, and perhaps so rapidly as not even to permit the more than doubtful chance of amputation. Yet it is plainly our duty to permit no anticipation of such untoward consequences to influence the care and attention bestowed on our management of the case. Let our treatment be, if possible, more painstaking than in ordinary circumstances; and it may be that our care is rewarded by a prosperous conclusion.

During the attempted cure much judgment is required, in both general and local management, more especially in the aged. Locally, we wish by bandaging and splints to keep the fragments in close apposition, and absolutely immovable. Constitutionally, we are desirous of supporting the *vis vitæ*; by generous food and other tonics, perhaps freely administered. But the following out of these indications, blindly and with rashness, is almost certain to induce chronic gangrene of the extremities, analogous to one form of the *gangræna senilis*. The bandage and splint must be only moderately tight; the diet must be nutritious, yet non-stimulant; the effects of both must be carefully watched; the water bed will, in many cases, be found signally useful; and should gangrene appear, notwithstanding all our care, the fracture must for a time be comparatively disregarded, and our attention mainly directed to the mastery of the more serious malady, according to the principles formerly detailed. By some the internal administration of alum has been recommended, but without any such cogent theoretical reason, or good practical results, as to lead to its re-employment.

When fracture has occurred in consequence of the cancerous diathesis,

often a malignant tumour forms at the site of injury, instead of the normal callus. But that result is by no means invariable; and therefore, even in these unpromising cases, our treatment should still be the same.

MOLLITIES OSSIUM, OSTEOMALAKIA, OR MALACOSTEON.

Both this disease and rickets are characterized by a deficiency, actual and relative, of phosphate of lime. In mollities ossium, the skeleton, originally of normal structure, parts with its earthy matter; becoming soft and pliable in consequence; while in rickets the osseous structure is abnormally developed from the first. In rickets, also, irregular development of the bone and its consequent distortion are slow and gradual; while in mollities ossium the softening of the completely ossified bone is rapid, and distortion may be both speedy and great. Further, in rickets, after a time, the abnormal condition is departed from; ossification becomes complete; the skeleton grows solid and unyielding; and the general health may be in a great measure restored. In mollities ossium, the untoward condition is usually steadfast, without amendment in the state of either health or skeleton; and the disease, sooner or later, almost always proves fatal. It occurs more frequently in females than in males; happily, however, it is a rare affection in both. Rickets, on the contrary, seems to have no predilection for sex; and is extremely common.

In mollities ossium, a copious phosphatic deposit is found in the urine, along with a peculiar albuminous substance. The general health is much and hopelessly impaired; flesh, spirits, and strength diminishing daily. The bones are light, soft, and greasy, with much enlarged cancelli; the osseous having been converted into medullary tissue. This excessive formation of medullary spaces gradually advances from the interior towards the surface, so that the bone may come to consist of a thin paper-like external shell, filled with soft matter; partly lardaceous, partly oily. When dry, the bones present a dark mahogany colour; when recent, the section has a dark brown, pink, deep crimson, yellow, or orange colour; due to the tint of the oleaginous particles of the softened and almost diffuent medullary tissue. When examined by the microscope, there is no excess, but rather an absence of blood-vessels; and the fatty matters consist of free oil, margarine, and empty collapsed fat cells. Sometimes much pain attends; in other cases, the unfortunates suffer little or no inconvenience. In one remarkable instance, related by Mr. Howship, a sense of tightness and much pain were complained of, at one particular spot; and there, on dissection after death, marked constriction and depression of the softened bone were found.

The disease may affect the whole skeleton; or may be limited to several bones, or to one. The pelvis may suffer alone; and is distorted peculiarly. The heads of the high bones, pressing against the acetabula, squeeze the sides of the pelvis inwards and upwards; while the sacrum is projected downwards. In rickets, on the contrary, the front wall of the pelvis is generally flattened, and the bones are of unnatural proportion and size as well as shape—both stunted and deformed. In mollities

ossium, on the contrary, the bones are of their natural bulk and proportion; and if their "various doublings were unfolded," the pelvis would be restored to its normal dimensions and form.



Fig. 130.

The cause of mollities ossium is involved in obscurity. Loss of blood, mercurialism, and whatever depresses constitutional power, are believed to predispose towards its occurrence. It is most common in the large manufacturing towns in England. In the case of Madame Supiot—a memorable example—the eating of much salt was a prominent peculiarity, which some were inclined to specify as a cause; but it seems to have been rather an accessory of the general perverted

state, than its origin. In some cases, the deficiency of calcareous matter in the bones seems to be accompanied with a copious deposit of it in the tissues of the lungs and stomach.

The disease is, according to present experience, incurable. As in other affections of a like nature, little more can be effected, in treatment, than palliation of the more prominent and distressing symptoms.

RICKETS.

As formerly remarked, this is a vice of the skeleton peculiar to early years. "In some instances, it has begun immediately after birth. It rarely, however, appears before the fifth or sixth month; and the most frequent period of its observed commencement is between eighteen and twenty-four months;"* in other words about the time when the child begins to walk. A rickety bone has three characteristics: 1st. The shaft is shortened; 2d. The epiphyses are enlarged; 3d. The normal curvatures are increased. Furthermore, this condition is attended, from the first, by a marked cachexy of system, which seems to be identical with the scrofulous. Usually, however, this becomes abated, after a time; even independently of remedial treatment. And coterminously with amendment of the general health, the abnormal condition of bone also disappears; a fact which has most important bearing on the treatment, and which should therefore be borne constantly in remembrance.

The bone is found to be abnormally developed. The process consists essentially not in a softening of the old bone, but in the non-solidification of the fresh layers as they form. The old layers being converted into medullary substance, by the normal progressive formation of medullary cavities, while the new layers remain soft, the bone becomes brittle. In a section of such a bone medullary substance, cartilage, calcified cartilage,

* Stanley on the Bones, p. 218.

osteoid tissue, and bone, will be found irregularly mingled together. Cancellous cavities, consequently, largely predominate ; containing a substance of a brown or reddish hue, soft, compressible, gelatinous, cartilaginous, fibrous, or even sometimes serous ; while in some cases a sanious liquid may be squeezed out, as if from wet leather. The whole bone is soft, easily cut with a knife, and, while the articular ends are preternaturally flexible, the shafts are liable to suffer deformation from incomplete fracture taking place within the periosteum which remains intact (Virchow). While such bones are chiefly defective in the regular development of their earthy elements, the animal matter too is changed ; for the extract obtained by boiling does not yield either chondrin or the gelatine of bone. Besides all this, comparative arrest of growth takes place ; as is seen especially in the lower limbs.

Sometimes the entire bone is expanded, even to a great extent ; the calvarium, for example, being in some cases found of more than double its usual thickness, and seeming to consist almost entirely of diplöe.



Fig. 131.



Fig. 132.

Sometimes, on the contrary, atrophy is the prominent change. In all cases, whether atrophy or expansion exist, the bone will be found much lighter than in the normal state. The flat bones are, perhaps, more frequently thickened than otherwise ; the long bones, usually, are shortened in the shaft, while they shew enlargement and flattening out of the articulating extremities. Such enlargement, however, is often

Figs. 131 and 132. Permanent curvature of the spine, with rotation, produced by rickets.

more apparent than real; depending mainly on the appearance due to the altered condition of the shaft. According to Mr. Stanley, actual expansion occurs only in those joints which are superficial; as the wrist, ankle, knee, and elbow. In these joints, certainly, the change is best marked and first observed. In all cases, epiphyses are more loosely connected than in health.

Although the whole skeleton may have thus degenerated, it is obvious that those bones will shew the change most, which are most exposed to muscular action, and to the sustaining of superincumbent weight. Consequently, we find the spine, pelvis, and lower limbs, most prominently distorted. The spine may be bent forward, or to the side; usually the curvature is lateral, with more or less rotation of the bodies of the vertebræ. These become squeezed in at the concavity of the curve—on the front or side, as the direction may happen to be; while, on the

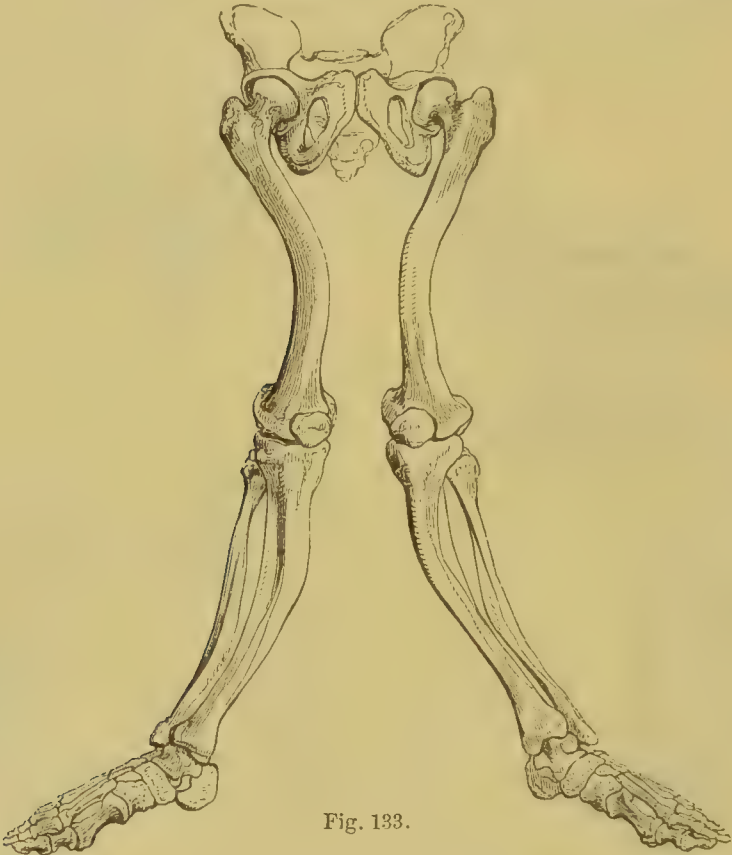


Fig. 133.

convexity, the articular processes become commensurately both thickened and enlarged. Antero-posterior bending has occurred to such an extent as to cause doubling of the aorta, adhesion of the opposed coats at the folded part, and consequent mal-nutrition of the lower limbs. The thighs and legs may have their natural curves merely exaggerated; or they may be bent in a variety of fantastic ways. Their bones, however, are not only bent but flattened, and the greater diameter of the bone is antero-posterior in relation to the curve; consequently, when completely ossified, they are not so weak as they otherwise would be. The heads and necks of the thigh bones bend downwards; and may ultimately come to be on a lower level than the trochanter. Arrest of growth, too, is strongly

Fig. 133. Example of limbs deformed by rickets.

marked in both legs and thighs ; imparting dwarfishness to the frame, as well as distortion. The articulating ligaments fail ; causing deformity of the knee and ankle-joints. The pelvis is small ; its front wall is flattened, and forced back upon the sacrum. And a characteristic hollowness is imparted to the loins, by the sacrum being thrust downwards ; its promontory becoming unusually salient, and its posterior surface forming the bottom of a hollow on the back part of the pelvis. At the same time both ilia are displaced backwards, so as to overlap the sacrum and approach each other ; sometimes leaving scarce an inch of space between their posterior borders.

The ribs follow the spinal distortion ; usually so as to produce a marked, and even sharp prominence of the chest, which is greatly contributed to by a bending forwards of the sternum. The clavicles have their natural curves increased. The scapulæ are not much changed ; except in shewing enlargement of the articulating surfaces. The bones of the arm and forearm are twisted, more or less ; but retain much more of their normal character than do the lower extremities ; the one set having to bear muscular effort alone, while the other has to contend with both this and superincumbent weight.

By alteration in the important visceral cavities, breathing is oppressed, and the assimilating organs are more or less embarrassed ; usually the abdomen is preternaturally prominent. The stature is stunted, dwarfish and unseemly. Besides, there are the ordinary characteristics of the scrofulous diathesis ; the child being usually flabby and fat, pot-bellied, and with, frequently, more or less enlargement of the thyroid and thymus glands. The forehead, too, is remarkably prominent ; and though the entire head is usually below the standard dimensions, yet from still greater deficiency of growth in the bones of the face, the cranium seems unusually large.

The features are marked, and developed with an unpleasant fulness ; the general expression of the face is displeasing, and altogether so peculiar as to be almost pathognomonic of the general disease. Although there may be unusual thickness of the skull, yet this is to be understood only in its literal sense ; for often the intellectual power is vivid and great.

The predisposing cause of rickets, as formerly stated, seems to be a vitiated state of system, analogous to that of scrofula. It occurs most frequently in a cold, moist climate, and among the children of the poor ; where malassimilation is produced by bad or insufficient food, and the want of suitable dwellings. Frequently, the exciting cause is traced by the friends to some of the debilitating accidents incidental to childhood ; as dentition, or some of the host of infantile disorders therewith connected. Often the change in the skeleton is first observed on the child's attempting to walk ; and then the primary deformity is of the lower limbs, chiefly below the knee. But even at this early period the enlarged wrists and ankles will be obvious. In the legs the knees approach each other ; the ankles diverge, and the shins curve forwards over the ankles ; a very different kind of bending from the ordinary bandy appearance, or mere exaggeration of the natural tibial curve, which so often occurs in the heavy but healthy child, who, perhaps prematurely, has begun to struggle

into the erect posture. After the lower limbs, the spinal column begins to yield ; and then follow the other component parts of the skeleton ; the multiplicity of bones affected being one of the characteristics of this constitutional disorder, and serving to distinguish it from curvature of single bones—and of the spine more especially—which do not depend on rickets, or any other vice of the general system.

In the case of the spinal column, it is important to remember that many examples of its bending are independent wholly of rickets. And that those cases alone are rickety, in which the system is plainly and primarily cachectic ; and in which the deformity, by bending, is not limited to the spine alone, but affects other bones as well ; more especially the ribs, pelvis, and lower extremities. This is a practical point which will be more fully dwelt upon, when treating specially of spinal curvature. Meanwhile, the points of diagnosis may be here shortly stated. Rickety curvature is comparatively rare in the better classes ; it affects both sexes alike ; it occurs in early years ; it is accompanied with distortion of the pelvis and lower limbs. Other curvatures, not rickety, are most common among the affluent and among females ; are most frequent between the ages of ten and sixteen years ; distortion is confined to the spine and ribs ; and there is not the same character or extent of constitutional cachexy as in rickets.

As the rickety patient advances in years, the disease does not proportionally become more marked, as is usually the case with mollities ossium. But at, or after puberty, if not before, phosphatic deficiency is found to cease ; the general health amends, flesh and colour are gained, the spirits rise, motion is more sought and better performed, the skeleton is found to be hardening in its texture ; nutrition has begun to be restored, and is gradually approaching the healthy standard. If means, suitable and successful, have been adopted ere this to undo the curves and restore straightness and symmetry of form, such firming of the skeleton is an unqualified boon. But if, as is not unlikely, remedies have been either wholly absent or imperfect in their operation, there results an irrevocable confirmation of the existing deformity.

This, however, is in some degree ultimately atoned for. The general health is regained ; as also power of motion to a certain extent. The muscular fibre becomes fully developed, and the muscles adapt themselves to the shortened and bent bones. The bones, though misshapen, are strong ; and yield no longer, to either muscle or weight. They contain at least the normal proportion of earthy matter ; and, besides, have been strengthened in their curves by new bone formed, sometimes copiously, in the concavity. The pelvic and thoracic viscera accommodate themselves to the altered circumstances of their including skeleton. And thus the patient, though perhaps a confirmed dwarf, and weak and puny in his boyhood, may notwithstanding prove a healthy, muscular, and tolerably active man.

Treatment.—The treatment of rickets must be mainly directed towards amendment of the general system ; as is plain from a consideration of the nature and cause of the disease. And, the inductive cachexy seeming to be identical with the scrofulous, a general treatment will be expedient, regarding diet, exercise, clothing, tonics, etc., similar to that

formerly recommended as tending to subdue the strumous diathesis, and to prevent establishment of local strumous disease. Friction of the general surface is of use; improving the skin, and at the same time promoting muscular development. Muscular exercise, too, will assist in fulfilment of the latter indication; but it must be both gently and briefly practised, otherwise the skeleton cannot fail to have its distortion increased. Absolute confinement to the supine posture will do more harm than good; by aggravating the constitutional debility, and general disorder. But its occasional use, for an hour or two at a time, or even for that period only which is usually allotted to waking repose, will be found of much service; relieving the weak spine, and lower limbs, from the weight imposed by the erect and semi-erect postures.

If the spinal column continue to bend, notwithstanding the persevering use of suitable constitutional remedies, and relief by posture, light mechanical support becomes essential. Not by the heavy cumbrous stays, ordinarily employed, at least in times not long bygone; an apparatus under which it would require the strength of a stalwart man-at-arms to move with comfort; and the miserable effect of which, on the delicate and weak patient, must ever be in the highest degree disastrous. But by a light and easy adaptation of mechanics, such as the well-informed modern artist now supplies; the object of which is to relieve the spine from the weight of the head, arms, and trunk, by taking it upon itself; without cramping the muscles by a tight unyielding embrace, or causing lassitude, fatigue, and absolute pain, by an unwieldy and overpowering encumbrance. The principle of construction is simple; light steel rods, supporting weight between the axillæ and the pelvis, and leaving the spinal column free; while, in some cases, a spring is made to act on that part of the chest which requires repression.

In the use of all mechanical supports, however, let the soft and yielding state of the whole skeleton be remembered; so that we may, if possible, not only relieve the parts most oppressed, but also do no harm, by undue compression, to those parts on which the duty of support is temporarily thrown. It would be but a bad result, in attempting to straighten the spine, to crush the pelvis.

When the lower limbs are but little bent, in the puny child, and the rickety condition is scarcely yet fully developed, no mechanical apparatus should be employed. The general treatment is to be earnestly maintained; moderate exercise is to be encouraged, the patient should be much in the open air, and diet should be full and nourishing. And generally, in such cases, the little patient, in common phrase, grows out of the deformity; the limbs spontaneously resuming strength and symmetry. But when curvation is great and increasing, and in other respects the rickety indications undoubted, light apparatus are certainly expedient; as fulfilling three salutary indications: preventing increase of the deformity; diminishing that which has already occurred, by applying reducing power in the required direction and degree; and enabling out-door exercise to be enjoyed, much to the advantage of the general health, and yet without prejudice to the limbs. And, in regard to this orthopædic treatment, let it always be remembered, that the time for its application is but limited. If the present opportunity be not improved,

the period is probably fast approaching, when by a complete change in the diathesis the bones become no longer pliable and yielding, but, resisting all remedial efforts, have their deforming curves permanently confirmed.

In curvature of the spine, not of rickety origin, but depending on either muscular debility, or awkwardness of muscular play induced by careless and improper attitude, benefit is sometimes obtained by maintaining the strictly erect posture during a certain number of hours in the day ; and by the poising of a light weight on the crown of the head. But, in rickets, ponderation of any kind will tend to prove an adjuvant, not of the cure, but of the disease. The principle of the former is not the imposing, but the abstracting of weight from the enfeebled column of support.

To the rickety female, celibacy should be strictly enjoined ; for, unfortunately, an “aptitude for conception” often exists, along with pelvic change and other circumstances extremely hostile to parturition.

TUMOURS OF BONE.

The simple or non-malignant tumours of bone are *Exostosis*, *Osteoma*, *Enchondroma*, *Osteocystoma*, and *Osteosarcoma* ; the malignant, *Osteocephaloma*, *Osteoscirrhus*, *Osteoid cancer*, and *Osteomelanosis*. There are also *vascular* formations.

Exostosis.

By this is understood a growth from bone ; of osseous structure, analogous to that from which it has sprung ; and following the same course of formation as in original ossification. Medullary cells are formed beneath the periosteum, which either pass into transitional cartilage or become directly transformed into bone, and thence the osseous outgrowth is gradually completed. At one time, the term was made to include all growths of bone ; fleshy, osseous, and cartilaginous. But, with propriety, it is limited to growth of bone from bone. There are varieties.

1. *The Dense or Ivory Exostosis.*—This is most frequently found in the flat bones, especially the calvarium. It consists of dense new bone intimately incorporated with the external portion of the parent bone, to which it is quite analogous ; its surface is usually smooth and polished like porcelain or enamel ; its outline forming the segment of a comparatively large circle,

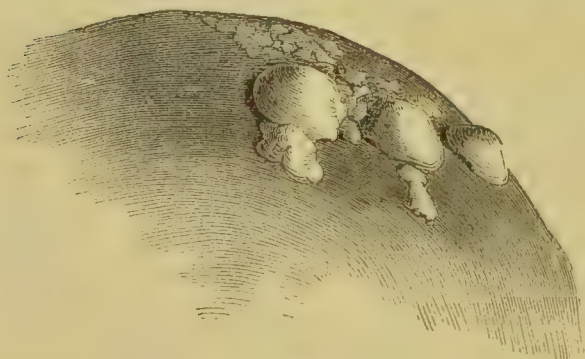


Fig. 134.

and the size seldom exceeding that of a nut, bisected. Growth is very gradual and altogether painless ; and having attained to a moderate bulk,

Fig. 134. Several ivory exostoses, clustered on the os frontis.

the process of development ceases, the superficial formation of cells being arrested by complete calcareous transformation. When superficially situated, as on the skull, external form is interfered with; and that constitutes the chief inconvenience. Sometimes, its origin may be remotely connected with a blow, or other injury; more frequently there is no assignable cause. No treatment is required. Were a commensurate formation to take place on the internal aspect of the calvarium, serious disorder of the cerebral functions might ensue; and were accuracy of diagnosis attainable, removal by the trephine would be expedient. But, fortunately, such an event seldom if ever occurs.

2. *The Cancellated Exostosis.*—A minor and adventitious bone, of irregular form, projecting from one which is primitive; structurally similar, in all respects, to its parent; having both an external laminated portion and internal cancelli; the latter either continuous with the cancelli of the larger bone, or shut off by the latter's external laminated portion. In other words, sometimes the exostosis seems to be formed on the parent bone, like the first variety; or it seems to grow out of it. However arranged, it follows the usual course; first cartilage, then bone; the exostosis, as it grows, always being covered by a cartilage of encrustation. When the extreme of growth has been completed, and the tumour remains stationary, then all is found osseous.

This kind of exostosis usually occurs only in the long bones of the extremities; and is most frequent in the femur at its lowest part. The upper end of the humerus is also a common site. In every instance the point of junction of the shaft with the epiphysis is the point of departure of these growths. The cancellated texture usually predominates; the external laminæ being thin and delicate. But in some cases the growth is dense at the neck or origin. There is an investing continuation of the periosteum; and this, usually, is separated from the muscular or other tissue by a serous-looking investing capsule.

Sometimes the attachment is by a narrow neck. And however narrow this may be, it does not materially enlarge with the rest of the tumour; increase taking place only on the latter's circumference. Still, the usual form partakes more of the cylindrical than of the pyriform.

This fact, of comparative non-enlargement at the point of attachment, has an important and obvious practical bearing, as regards removal of the formation.

In some cases, the size is small, and occasions little or no inconvenience; in others, the exostosis projects several inches among the muscles of the limb, greatly impeding their function. Sometimes the tumour, though small, produces serious inconvenience by pressure on important parts. Growing from the first rib, it has displaced and flattened



Fig. 135.

Fig. 135. Cancellated exostosis; growing from its most frequent site, the lower part of the femur; and, as usual, inclining upwards. *After* DRUITT.

the subclavian artery ; simulating aneurism. Growing from the lower cervical vertebrae, it has compressed the same artery, and caused gangrene of the limb. Of similar origin, it has compressed the œsophagus, producing dysphagia. Growing from the odontoid process, it has caused fatal pressure and softening of the spinal cord. Projecting backwards from the pubes, it has caused retention of urine, and even produced organic change in the bladder. Growing inwards from the cranium—fortunately a rare event—it has occasioned epilepsy.* Growing from the neck of the humerus, it sometimes overlaps the vessels and nerves in the axilla.

Increase is more rapid than in the ivory exostosis ; but still slower, and more insensible, than enlargement of an inflammatory kind.

Sometimes the origin may be connected with external injury. Pain and swelling ensue, of an inflammatory character ; the inflammatory process and its pain subside, but the swelling remains ; resolution is incomplete ; and subsequently the enlargement is continued, of a circumscribed and prominent character. Not unfrequently, the exostosis is found at the site of a muscular insertion, where a process of bone naturally exists ; and, by the play of that muscle, it has been supposed that an exaggeration of the normal “process” into an abnormal exostosis is gradually produced.

In some cases, an ossific diathesis may be said to exist ; even a slight blow being followed by an exostotic formation. Such cases, however, are rare. The skeleton, so susceptible, is prone rather to the inflammatory process, and its results ; abscess, ulcer, caries, and necrosis.

In the majority of cases, this variety of exostosis may be left undisturbed ; hoping that by and by the ultimatum of growth will be reached, and matters will settle down accommodately. Interference is warrantable only when bulk and position are such as to interfere with important functions—as of muscles, vessels, cavities, canals, or internal organs. Then an incision may be made, the neck of the growth severed by a saw or bone-pliers, and the exostosis carefully removed. Cases demanding such treatment, however, are comparatively rare.

When a fleshy part is operated on, such as the thigh, it is well to make the wound more or less transverse in direction, and to use no stitches, plasters, or other means towards primary union ; the main object being to prevent retention of suppurative discharge. For the wound invariably inflames acutely ; pus forms rapidly and profusely ; and the serious dangers, local and constitutional, of confined and infiltrated inflammatory secretions become imminent, unless the wound be patent and free. Patients have not unfrequently perished from the inflammatory accidents of this operation. And, in consequence, as already stated, it is not to be resorted to as an ordinary and innocent procedure.

A small exostosis, protruding from the distal phalanx of the great toe, is not uncommon ; and generally causes so much lameness, and other inconvenience, as to require removal. It is sufficient to take away the exostosis alone ; dividing the soft parts on either side of it by a Δ shaped incision—its apex beneath the nail—and then shaving off the growth with the point of a stout Wharfedale blade. Formerly it was

* Stanley, p. 154.

thought necessary to remove the phalanx also, either in whole or in part.

Sometimes, by external injury, an exostosis sustains fracture. An acute inflammatory process is then apt to be lighted up; the fractured portion dies; and suppuration takes place around. Under such circumstances, incision is required; free enough to permit not only evacuation of the abscess, but also removal of the necrosed portion.

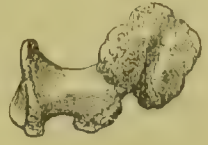


Fig. 136.

Repeated injury may fail to produce fracture, but may cause degeneration, even of this simple structure, into a soft and malignant growth; demanding ablation of a more extensive and formidable kind. This untoward change is more likely to be simulated than real, however: as thus—

After injury, the part becomes painful, tender, and manifestly of increased growth; while a most suspicious sense of elasticity is imparted to the examining hand; and at the same time the system is begun to sympathize more or less. The lump looks medullary, and thoughts of amputation begin to suggest themselves. Instead of this, however, in addition to absolute rest, apply a few leeches with fomentation—and wait. Within a few days the unfavourable symptoms all disappear; and the swelling recovers its usual bulk and innocence. What had happened was an effusion of serous fluid between the surface of the exostosis and its investing capsule, the result of a simple inflammatory process there.

Osteoma.

Exostosis is a growth of bone from bone. Osteoma is an enlargement of the bone itself; hypertrophy, accompanied with condensation of structure; and unassociated with the inflammatory process—therein differing from node. The enlargement is very gradual, and unattended by pain. External injury may be the remote apparent cause; or no cause may be assignable. In any part of the skeleton, it is comparatively rare; but the long bones of the extremities, and the lower jaw, may be reckoned its usual sites. The size is seldom great. A section discloses density of structure; excepting perhaps a little portion of cancellous texture in the centre.

This affection of bone is, originally, most simple; and may long remain so. Yet it is liable to degenerate; either in consequence of repeated injury, or on account of an evil disposition having crept into the general frame during the advance of years. I have seen a section of such a tumour, dense and osseous throughout, except just at the centre; where an open space not larger than to enclose a small nut, instead of being occupied by cancellous texture—as it, no doubt, originally was—contained a distinctly cerebriform substance. Early treatment, therefore, is expedient.

In the first place, arrest of growth and discussion are to be attempted by the ordinary means; but failing discussion, if the affection only exists in one bone, and not in several, as is sometimes the case, extirpation may be had recourse to, by the knife and saw.

Fig. 136. Exostosis of the distal phalanx of the great toe.

Enchondroma.

This is a cartilaginous growth, connected with bone, chiefly occurring in the young and middle aged, and usually attributable to external injury. The form is spheroidal; the size sometimes equals, but seldom exceeds, that of an orange. The tumour here figured (Fig. 137) is of unusual size; it weighed fourteen pounds.

The nature of the tumour is strictly benign; and there is little tendency to degeneration, even when, after many years' duration, ulceration of the investing integument may have occurred. In the case already alluded to, growth had been long continued, the size was very great, and ulceration of the surface was extensive. Repeated hemorrhages, too, had occurred; and the patient looked cachectic. Nevertheless, section of the structure shewed nothing but purest enchondroma. At the same time, cases, though few, are on record, in which degeneracy seems to have begun; the interior of the tumour softening and breaking down, not by inflammatory but by malignant change; the surface then ulcerating, and discharging foetid sanies from the centre.

All parts of the skeleton are liable to the formation; but it is most frequently found in the metacarpal bones and phalanges of the fingers. The articulating cartilages are not involved, but form the limits of the growth in that direction; and adjacent tumours have no tendency to coalesce, but rather remain distinct. Occasionally, several tumours are simultaneously developed.

The structure consists of two parts; a fibro-membranous interlacement, forming cells of different sizes, some equal to that of a pea, within which is contained the cartilaginous matter. The general appearance of the section's structure is strikingly conglomerate; and, in consequence, slight inequalities are usually imparted to the surface of the tumour.

There are two varieties. 1. The adventitious growth is developed in the interior of the bone. The formation gradually takes place in the cancellous texture; and the external portion, or shell, proportionally dilates. This outer shell, though attenuated by distension, yet receives addition of new osseous matter from time to time; and long retains

its continuity. Ultimately, it becomes very thin, and in some places membranous; still the tumour retains its smoothness and spheroidal shape. This variety, then, is invested by both bone and periosteum; and it is that which most frequently occurs.

2. The second variety—much less common—is formed on the exterior of the bone; and is covered only by the periosteum and other soft parts. It is generally met with in the flat bones; cranium, pelvis, and



Fig. 137.

Fig. 137. The large enchondroma referred to. At *a*, a section made to shew structure. At *b*, the ulcerated surface, whence the bleeding came. Amputation was performed at the wrist, successfully.

ribs. The interior of the tumour is the same as that of the preceding ; the form is less regularly spheroidal, and the surface is more unequal.

Treatment.—When enchondroma is very small and recent, there is some reason to believe that discutients, such as mercury and iodine, may not only check but gradually disperse the tumour. In the great majority of cases, however, this is in no degree amenable to absorption ; and therefore demands removal by the knife. The second variety, external to the bone, may sometimes be simply dissected away, the bone remaining entire ; but more commonly, like the first, requires ablation of that portion of bone from which it is produced. And if removal have been complete, reproduction need not be anticipated.

Osteocystoma.

This in some respects resembles chronic internal abscess ; by the ancients supposed to be of a windy character, and hence, improperly, called *Spina Ventosa*. A membranous cyst forms in the interior of a bone, causing equable expansion of the laminae ; and forming a cavity occupied by straw-coloured serous-looking contents, usually clear and glairy, sometimes, however, resembling lard in consistence. The parietes, as the cavity slowly enlarges, are more and more attenuated ; at some points they become membranous, and ultimately the membrane may give way. No great amount of osseous formation accompanies the dilatation, as in chronic abscess ; and the morbid process is from the first non-inflammatory. The cavity is lined by a serous-looking membrane ; and sometimes membranous septa subdivide the space, as in compound serous cysts of the soft parts.

The distinctive characters of the swelling thus are :—the contents seldom, if ever, truly purulent ; the parietes little more than simply expanded, and consequently attenuated ; the formation neither preceded nor accompanied by inflammatory change ; commencing in the cancellated interior, by non-inflammatory formation of a cyst, which partakes largely of the serous character.

Treatment is similar to that of the simple and compound cysts of the soft parts ; puncture, satisfactory evacuation, external support, internal stimulation if necessary. Partial ablation of the external wall is sometimes necessary ; and in cases of compound cysts, entire removal is essential for cure. Even where the cyst is a simple one, amputation may be required. For example, the affection is not unfrequent in the phalanges of the fingers ; and if one of these be wholly expanded into a large cyst, it is prudent at once to amputate the whole or part of the finger, instead



Fig. 138.

Fig. 138. Osteocystoma, of large size ; occupying lower end of femur. Prep. in University Museum.

of attempting a protracted, under such circumstances certainly an imperfect, and probably an abortive cure by incision. In the case of a large bone where the cysts have attained to a large size, similar severity of procedure is even more requisite, as shewn in the accompanying illustration.

After the treatment by incision, with partial ablation of the distended wall, and dressing from the bottom, the cure is often—nay generally—all that could be desired. Sometimes, however, the swelling is reproduced, either by repetition of the cyst, or by solid formation coming in its room—osteosarcoma.

Osteosarcoma.

By this is understood a tumour composed partly of bone, partly of fleshy substance—as the name implies; the latter constituent of a simple and non-malignant kind. The formation is usually attributable to external injury, perhaps slight; and originates either in the cancellous

texture of the interior of bone, or beneath the periosteum on its surface. The osseous part is analogous to the fibrous interlacement in tumours of the soft parts. It is, as it were, the stroma in which the other constituent is produced; dense, solid, and roughly granulated (Fig. 144) in some instances, in others spicular and foliated (Fig. 139), leaving interstices, more or less wide, in which the fleshy substance is lodged.

The interstitial structure is of different kinds. In some cases, it is partly cartilaginous; in others, of a fibrous character; in others it is myeloid. Cells or cysts, too, are usually found; being probably formed from the fluescence of some portion of the tumour's substance, or from the gradual enlargement and coalescence of certain cellular structures forming a part of the fleshy growth. These are filled with fluid, sometimes glairy and clear, sometimes serous and turbid. They are seldom of large size, but may be numerous.



Fig. 139.

The very fact of their existence in a fleshy tumour indicates a tendency to further change in its intimate character; and thus it is that within them, as endogenous growths, or connected with them, degenerations of such tumours into medullary cancerous formations begin.

In those cases where this fleshy growth is developed in the interior of the bone, the exterior shell becomes expanded. And, as in enchondroma, the latter for a time retains its continuity, in some places even with an increased thickness, by new osseous formation; but, ultimately, at cer-

Fig. 139. Osteosarcoma of the lower part of the femur; macerated. The fleshy part of the tumour removed, the spiculated osseous stroma remains.

tain points—and these are usually towards the external surface—it becomes first thin, and pliable as parchment, and then entirely membranous. Even the membrane, after a time, gives way. And the superimposed soft parts, too, may tighten, inflame, and ulcerate, thus exposing the true structure of the morbid growth. But no sprouting fungus results, no hemorrhage, no foetid ichorous discharge. The discharge is purulent and moderate ; the sore is simple ; and even cicatrization may be effected.

Growth is slow. Many months may have elapsed, and the tumour may still be no larger than an orange. Pain can hardly be said to attend ; yet there is more inconvenience and discomfort felt, in and around the part, than in the simpler and more tardy formations of exostosis and osteoma. Pressure does not increase pain materially, if at all. When made firmly, a crackling sensation is often experienced ; partly from displacement of the parchment-like portions of the osseous shell, partly from interference with the osseous skeleton of the mass. The sensation of firmness, imparted to the touch, is less than that of exostosis or osteoma ; much greater than that of osteocephaloma. There is no elasticity ; and the presence of fluid accumulation is not simulated. There is little or no constitutional disorder ; unless important function be interrupted by the bulk and position of the tumour. Often the patient seems to be, in all other respects, of even robust health.

This tumour seldom appears before adult age. It is originally simple, and may long remain so ; but nevertheless it may degenerate from even slight causes, local or constitutional. Rapid growth, great pain, open condition, fungous protrusion, involvement of surrounding parts, and marked constitutional cachexy, may supervene after the infliction of but a trifling injury. Early removal, therefore, by excision or amputation, is in the highest degree expedient ; while yet the tumour is small, and the wound may be slight and safe ; while yet the structure and tendency are simple, and immunity from return may be secured.

When a long bone is affected by osteosarcoma, in its shaft, as but seldom happens, fracture at that point is not unlikely. After such a casualty, amputation is imperative. There is no chance of reunion ; but, instead, rapid enlargement, with perhaps avowed malignancy of the tumour.

It will be observed that under the term Osteosarcoma are included all the solid non-malignant tumours of bone—excepting exostosis, osteoma, and enchondroma. This may be inexact and unscientific ; but it is of practical value, as tending to bring out the contrast between such formations and those which follow—the truly malignant.

Osteocephaloma.

This term denotes the medullary formation as it occurs in bone ; a most malignant and intractable tumour ; and, unfortunately, not of rare occurrence. When osteosarcoma degenerates, it is to assume the characters of this. Then, instead of fleshy interstitial substance, of a simple kind, there is medullary change ; commencing usually at a central part. The osseous skeleton for a time remains ; but sooner or later it disappears, and its place is occupied by a soft brain-like mass. The ex-

terior osseous shell, in like manner, is involved ; the surface is reached ; ulceration follows ; and the medullary substance, then exposed and unconfined, quickly establishes the condition of fungus. The articular cartilage is usually the structure most resistful, long continuing as a crust or coating at that portion of the tumour which corresponded to the articular end of the bone. The absence of communicating channels between the cells of cartilage, by which the imbibition of diseased fluids from the tumour to the cartilage may occur, has been presumed to explain this undoubted fact. Still cartilage does in some cases yield before the advancing growth. Then the cartilage corpuscles multiply, the hyaline substance becomes proportionately smaller, as well as fibrous in character ; and both cells and fibres are fused with the cancerous growth. In other cases the cancer extends from the bone to the synovial membrane, and thence over the surface of the cartilage, enclosing it to some extent within the cancerous structure.

More frequently, the tumour is primary. Medullary from the first ;



Fig. 140.



Fig. 141.

making no change, except from the occult to the open state, and perhaps to assume the condition of fungus hematodes ; rapid, painful, involving all textures, pushing none aside, and attended by a most marked and wasting cachexy. Sometimes the origin is in the cancellous tissue, ex-

Fig. 140. Section of Osteocephaloma affecting the lower part of the femur ; a very common site. The whole bone at that part is converted into a pulpy brain-like mass ; the articular cartilage alone remaining entire.

Fig. 141. Osteocephaloma of the femur, near its middle. Fracture occurred previously to amputation. Patient recovered.

panding the bone from within ; sometimes the first formation is periosteal ; and sometimes the disease originates in the soft textures exterior to bone, and involves the latter secondarily. In the latter class of cases, the continuity of the shaft may be maintained throughout the whole progress of the disease, the laminated texture, however, disappearing, and in its place plates and spicula of delicate spongy bone radiating throughout the substance of the mass, and constituting an osseous skeleton of support to the cancerous formation. By some this is considered as a form of osteoid cancer.

When the tumour forms in the shaft of a long bone, fracture is still more likely to occur than in osteosarcoma ; greatly aggravating the untoward progress of the disease.

Treatment is by early and thorough removal. Amputation of the limb is usually preferable to extirpation of the part ; and it is a safe general rule, that, when practicable, the bone in which the tumour has been produced should not be sawn through at any part, but disarticulated. If an opportunity for early interference be not afforded, the knife should be withheld, and palliatives alone employed.

Diagnosis.—Practically, it is of the utmost importance that we should be able to distinguish between osteosarcoma and osteocephaloma. Both are of frequent occurrence ; and each requires distinct rules of treatment. The most common sites of each are the maxillary bones, lower and upper ; and next, the long bones of the extremities, especially the heads of the tibia and fibula, and the corresponding end of the femur. But the flat bones, as the scapula, cranium, and pelvis, are by no means exempt.

The prominent points of difference are the following ; sufficiently distinct to protect the experienced and careful.

1. Osteosarcoma is seldom found prior to adult age ; Osteocephaloma may occur at any period, and is perhaps more common in the adolescent than in the adult.
2. Osteosarcoma is usually attributable, in its origin, to external injury. Osteocephaloma is more frequently of spontaneous growth.
3. Osteosarcoma is slow and gradual, and more or less uniform in its growth. Osteocephaloma is much more rapid, and tends to enlarge unequally ; growing chiefly at those points where there is least mechanical resistance.
4. Osteosarcoma, usually, is almost, and sometimes altogether painless ; unless when some nervous trunk or plexus is compressed. Osteocephaloma, from the first, is attended with severe lancinating pain.
5. Osteosarcoma is firm, and yields but little to the touch ; even rude pressure is scarcely painful ; an obscure crepitus is often felt. Osteocephaloma is soft and elastic, from an early period ; the shell of bone, and all other remains of the original texture, soon becoming merged in the medullary formation. It is elastic, and affords no crepitus—when an original tumour ; and pain is aggravated by even slight compression.
6. Osteosarcoma entails but little disorder of the general health. Osteocephaloma is attended with marked cachexy, even from the beginning.
7. A casual abrasion of the skin, or mucous membrane, investing an osteosarcoma, shews a simple character ; and may be brought to heal, under ordinary treatment. A similar breach in the surface of an osteocephaloma does not heal, but widens more and more,

and becomes the site of fungous protrusion. 8. Osteosarcoma does not invade the neighbouring tissues ; but pushes them aside by its expansion, and abides within the bone in which it was first developed. In the upper jaw, for example, it remains limited to the expanded confines of the antrum. And, at those parts where the bony and even membranous parietes are deficient, there is no ulceration followed by fungous protrusion ; but only a moderate increase of growth, in a lobulated form, with or without a rawness of the surface. Osteocephaloma, on the other hand, pushes no texture aside, but early involves all ; the antrum is soon passed beyond ; the base of the cranium is affected, even before much appearance has been made externally ; and wherever deficiency of the investing texture occurs, ulceration and fungous growth are sure to follow. 9. Osteosarcoma long continues in the occult condition. Breach of the surface, when it does occur, does not extend rapidly, and evinces no malignancy of character. The discharge is purulent, or puri-



Fig. 142.



Fig. 143.

form ; not profuse. There is no tendency to hemorrhage, unless by accidental injury ; and then it is slight, and easily restrained by pressure. Osteocephaloma soon passes from the occult to the open state. The ulcer spreads, and is obviously the seat of malignancy. Discharge is profuse, foetid, and bloody. Hemorrhage is not unlikely ; of spontaneous origin, and little amenable to control. 10. Osteosarcoma does not spread ; either by contiguity in the tissues, or remotely by the lymphatics. Osteocephaloma does both ; at an early period, the lymphatics are manifestly and hopelessly involved.

Such are the striking differences between the two tumours. The distinction is equally great in the treatment applicable to each. If the tumour be an osteocephaloma, operation is warrantable only at a very

Fig. 142. Osteosarcoma of lower jaw. Hard, smooth, non-ulcerating. Slow in growth.—LISTON.

Fig. 143. Osteocephaloma, contrasted with the preceding. Soft, fungus, ulcerous, rapidly enlarging, and involving all textures.—LISTON.

early period, when there is a certainty—or good hope, at the least—that the whole of the affected parts, and something more, can be wholly removed; and when the constitution does not seem to be much and irreparably involved. An osteosarcoma, on the other hand, admits of operation till a late period. Its extirpation may be fearlessly attempted, with a good hope of success, even after the tumour has attained an enormous bulk; and experience has fully shewn, that though the operation may be bloody and severe, yet it seldom terminates but in a fortu-



Fig. 144.

nate issue. In a case closely resembling Fig. 144, no single bad symptoms marred the cure, which was permanent.

In regard to prognosis also, the tumours widely differ. After removal of an osteocephaloma, even under favourable circumstances, we can never be certain of immunity from return. When a genuine osteosarcoma, on the contrary, has been taken away, the mind may be at ease. For return is very improbable; even when the operation has been performed at an advanced age of both tumour and patient.

Osteoscirrhus and Osteo-cancer

Is comparatively rare. When it does occur, it may be either as a mass of hard, elastic, gray, and shining aspect, formed by a gradual invasion of the osseous and medullary substance, which disappears by transformation into the cancerous mass; or we may find the cancelli still existing of their normal size, or perhaps diminished by transformation of the outer layers of the medullary cells in each cancellus into new bony matter, while the inner portion becomes converted into a true scirrhus substance.

Fig. 144. Large Osteosarcoma of upper jaw; macerated, shewing the osseous stroma. Still limited to the superior maxilla, in which it originated.—HOWSHIP.

This form of cancer is usually met with as a secondary disease ; the primary affection having been either a scirrhus in the soft parts—as in the mamma, or perhaps a medullary, osteoid, or colloid disease of the same bone, in another part of its shaft or extremities. The scirrhus of bone rarely produces any great tumour ; its limit is usually the periosteum, so that in some instances where nearly the whole extent of the bone was involved, it retained, with but little change, the original form and shape. The formation of such secondary growth may be excited by the occurrence of fracture. More commonly the order of events is reversed ; the tumour gradually expanding, and thus attenuating the bone walls by its growth from within ; and the bone, thus changed, snapping across during some slight exertion. Under such circumstances, all hope of cure is vain—even by amputation.

Osteocancer, a malignant ulceration of bone, is not uncommon. Usually of secondary origin also ; the invasion having come from the soft parts. A malignant ulcer of the scalp, for example, not unfrequently involves the subjacent skull in a hopeless loss of substance ; and epithelioma, beginning in the skin, may soon excavate the tibia, or the upper or lower jaw, as the case may be. Such an occurrence, in either of the extremities, would warrant amputation ; unless lymphatic tumour, or other indication of an irrevocably involved system, should contra-indicate all active interference.

Osteoid Cancer.

As already mentioned, the medullary tumour originating from the periosteum and surface of a bone, and possessing an osseous framework or skeleton in the form of radiating plates and spicula, is regarded by some as an example of this form of disease. In its true form the tumour is characterised by its elongated oval shape, its smoothness of surface, its incompressible hardness, and the pain which accompanies it ; resembling in these respects a simple ostitic enlargement. On dissection, it is found contained within the thickened and adherent periosteum, of a smooth or broadly tuberos surface. On section, it is found to consist of a very compact, hard, lamellated, or finely porous osseous tissue, of which the whole mass, except the exterior part, consists. This latter portion is composed of dense tough fibrous substance. Examined with the microscope, these tumours consist of short stunted reticularly-arranged fibres, closely matted together, with cancer cells sparsely scattered among their interstices, but with an abundance of connective tissue cells ; and these may be observed becoming transformed by the calcareous transformation of surrounding parts into lacunæ. The hard portion of the tumour in fact consists of bone, more or less perfectly formed, with a cancerous development of its medullary substance. These tumours grow rapidly, exhausting the patient by pain and the early development of the cancerous cachexia, as well as by the involvement of the lymphatics in malignant disease. Early amputation is the only means of relief, but with an unfavourable prognosis.

Osteomelanosis.

This disease, too, is usually secondary, and not recognised by any external signs from the other forms of medullary cancer, until examined after death of the patient, or removal of the tumour. The melanotic matter is either infiltrated or in distinct patches. Sometimes it is separate and distinct; more frequently, as in soft parts, associated with medullary formation. There is no remedy but by amputation; and the cases are few in which that operation will be deemed expedient.

Vascular Tumours of Bone.

Bone may be variously affected by a morbid condition of the blood and blood-vessels. 1. *Osteoaneurism*.—A kind of aneurism, it is alleged, may form in the cancellous texture; an artery dilating, giving way, or otherwise communicating with a sac, in which blood accumulates so as to distend the laminated portion into the form of a tumour of greater or less magnitude. The sac is composed of thin osseous and periosteal walls, with osseous plates projecting inwards at parts of their surfaces, presenting a honey-combed appearance on the interior. This disease may follow upon an external injury, which may be supposed to have ruptured the arterial coats; or it may form spontaneously, by arterial degeneration. It is said to have occurred in the head of the tibia, the condyles of the femur, the scapula, and the clavicle. A cure has been effected where the head of the tibia was affected, by tying the femoral artery; at the same time applying uniform sustained compression of the tumour. Such a result must be regarded as exceptional; and in most cases removal of the whole of the affected bone by amputation will be expedient; if the part be so situated as to admit of this operation. For were the disease left to itself, the open condition would, sooner or later, be attained; and death by hemorrhage ensue. A remarkable example of this disease occurred to Mr. Liston, and is related in his *Elements of Surgery*, p. 170.

2. Erectile tissue may become developed in the cancellous texture, expanding the laminated portion of the bone, which comes to form, as it were, its outer case. The symptoms are necessarily obscure. Fortunately, the occurrence is rare. Deligation is plainly inapplicable. Amputation must be had recourse to.

3. Either of the preceding varieties may be conjoined with medullary formation. In such circumstances, early and free removal by the knife is plainly and urgently indicated; but with an unfavourable prognosis, as to the probability of return. It was in a case of this kind that Mr. Syme first excised the scapula.

In all these different forms of the disease, the affection is a painful one from the commencement. In the early stages of the case the diagnosis is rendered difficult, as the bone at the part affected is only slightly enlarged. In the more advanced stage, when a considerable thinning of the osseous walls has occurred, the disease is characterised by the unequal resistance afforded by different parts of the tumour, by a senso

of crackling when the thin osseous plates composing parts of the sac yield under pressure, and by more or less obscure pulsation or throbbing felt by both patient and practitioner in the tumour itself.

Pulsating Tumours of Bone.

Certain enlargements of bone are observed to be endowed with pulsation; this varying from a mere thrill to the strong impulse of an aneurism. The cause is various. It may be from the inherent structure of the tumour, as in erectile tumour of bone, and osteoaneurism. Or the nutrient arteries of the bone may be preternaturally enlarged. Or it may be in consequence of an osteocephaloma overlaying a large artery, or being permeated by one or more, and so receiving their impulse; thus simulating the aneurismal state, as tumours of the soft parts do in like circumstances. Sometimes, nay often, bruit accompanies pulsation. And, in consequence, accurate diagnosis may be rendered very difficult. It is apparently most distinct where the bulk of the tumour is supported by dense bone, so that the communicated pulsation is reflected, as it were, entirely in one direction. Lately a patient was sent to me, said to be affected with popliteal aneurism. The tumour proved to be medullary enlargement of the lower end of the femur, possessed of very remarkable pulsation—and this depending not so much on the vascularity of the mass itself, as on the play of enlarged articular arteries exterior to it.

Entozoa in Bone.

Hydatids have not unfrequently formed in the cancellous texture of bone. Under their accumulation the walls of the bone expand, so as to form a tumour of greater or less size, and of varied form. And then, attenuation and deficiency of the parietes taking place, the hydatids may escape into the superimposed soft tissues; causing suppuration there, and subsequent discharge of themselves along with the purulent secretion. In a flat bone, such as the cranium, removal of the disease may thus be obtained, with the aid of surgical interference. In the long bones, the occurrence is likely to lead to fracture, under very inauspicious circumstances.

Treatment, accordingly, will vary according to the extent and site of the disease. The bone may be exposed by incision, the hydatids and altered osseous tissue may be scooped and gouged away, and the parts may afterwards granulate and heal kindly. Or it may be necessary at once to proceed to amputation.

CHAPTER XIV.

DISEASES OF THE JOINTS.

FORMERLY, all the grave examples of disease in joints were included under one common designation, "*White swelling*;" a custom, scarcely convenient, which led to much confusion and inaccuracy as to the nature of the affections, as well as to uncertainty in their treatment. But, thanks to the labours of modern surgeons—among whom, in this department, the name of Sir Benjamin Brodie stands pre-eminent—much of this confusion and uncertainty have been dispelled; and each disease, set forth in its proper site and character, may have its appropriate remedy or system of treatment assigned. As can be readily understood, however, such discrimination can be practised only while the disease is yet comparatively recent; for, after a time, the morbid process, in whatever texture it may have originally dwelt, involves the whole articulating apparatus in one chaos of disease. It is at the beginning of the attack that treatment is most likely to prove successful; and fortunately, it is at the same period that we enjoy a facility and accuracy of diagnosis.

We shall consider, in succession, the results of disease in the different component textures of the joints; 1. In the Synovial Membrane; 2. In the Cartilage; 3. In the Bones.

SYNOVITIS.

By this term is meant the inflammatory process occurring in synovial membrane. It may be either acute or chronic.

Acute Synovitis.

The inflammatory process tends to spread from one part over the whole membrane, to be accompanied with much inflammatory product, and to result in serious change of structure. At first, the membrane becomes congested, turgid, and shews an apparent increase of vascularity, especially in the plicæ vasculosæ; the natural secretion is poured out in increased quantity, and of a more aqueous character than in health. This necessarily causes general swelling; which forms almost synchronously with the first painful indication of the morbid process, and is diagnostic of the affection. Then the membrane begins to change in structure. It becomes thickened, soft, red, almost pulpy; and loses its translucency, as well as the smooth glistening appearance of its internal surface. At this time the inflammatory product ceases to be chiefly serous, and contains more or less of fibrin, usually floating about in detached flakes; and

also plastic material is found over the surface of the membrane, as well as in its parenchyma. It is at this stage of the process that adhesion may occur between two opposing portions of the membrane; causing obliteration of some part of the joint's cavity. But this result is of comparatively rare occurrence; probably for two reasons. First, the process usually tends rapidly onwards, and soon overpasses the opportunity for plastic formations; quickly arriving at the suppurative and ulcerative stage. Second, because the presence of much fluid in the joint is plainly inimical to adhesion; the surfaces being separated by the distension.

Subsequently, as the suppurative crisis is approached, and also after it has occurred, change of structure increases. The membrane, besides being thickened and changed in itself, becomes incorporated with the plastic material which was formed on the free surface; and which has assumed a membranous appearance and function. From this, purulent secretion is continued in greater or less quantity. And the contents of the joint, at first serous, then sero-purulent, now become wholly of the nature of pus. Throughout the whole period, the superimposed soft parts have been sympathizing closely; themselves involved in a minor grade of inflammatory change, and consequently becoming swollen and infiltrated thereby.

The symptoms are sufficiently distinct. Pain is early and severe. It is constant; and, gradually increasing in severity, ultimately becomes intense. There is swelling; also gradually on the increase, sometimes becoming great; and, as already stated, its accession is synchronous with that of pain. The swelling is not altogether uniform; but is much more so than in the chronic form of the affection. The joint naturally becomes most prominent at those points where there is least resistance; in the knee-joint, for example, bulging is chiefly lateral, and beneath the tendon of the quadriceps muscle. But then such peculiarities of bulk become very much obscured and masked by general cedematous swelling of the superficial parts. The skin is red, tense, hot, and sensitive. The pain is general; pervading the whole part, but greatest in the interior; much aggravated by pressure, and altogether intolerant of the slightest motion.

A position is assumed, naturally, in which the parts affected are most relaxed, and pressure removed from the opposed surfaces. And, besides, as the joint fills with its fluid contents, flexion necessarily occurs from a physical cause. Relief is felt from this posture; and it is not only assumed but maintained involuntarily. Also, the muscles in the neighbourhood are involved. Their tonicity is increased; as evinced by firm solidity of the muscular fibre, and rigidity of the tendon. For example, when the knee is affected, we find it in a state of semiflexion, with the ham-strings tense and hard as cords. The muscles are liable to spasm also; whereby involuntary startings of the limb occur, especially during the short and uncertain periods of disturbed sleep; and by the jerking motion thereby occasioned, all the symptoms are much aggravated. The constitution labours under inflammatory fever, of a grave kind; which increases with the progress of the local disorder.

On suppuration having occurred, there is marked aggravation of all

the symptoms, both constitutional and local ; and a succession of rigors usually ushers in the exacerbation. Fever rises higher, and the system is proportionally more oppressed ; swelling is larger and more tense ; the pain, heat, and feeling of tightness are increased, accompanied with a deep-seated throbbing ; and each pulse seems still further to augment the pain. The superficial swelling becomes of a more urgent character ; being the result, now, of a higher grade of disease. Fluctuation within the joint also changes its type ; and affords to the experienced touch a tolerably certain indication of pus. At one or more parts, the swelling begins to point ; the matter now approaching the surface, through the intervening textures. Ultimately the integument, at the prominent points, either gives way or is opened artificially ; the matter is discharged ; and the joint's cavity is exposed. For a short time, immediately subsequent to evacuation, the more urgent symptoms may subside ; from the relief of tension. But very soon, a second aggravation generally ensues ; even greater than that which followed the first formation of matter. A fresh inflammatory attack, as it were, seizes on the interior of the joint ; and the destructive process ranges anew, accompanied by violent constitutional disturbance, perhaps now of the irritative rather than of the inflammatory type. This, in its turn, is not unlikely to give way to hectic ; the whole joint having become a prey to the worst inflammatory results, and the system beginning to sink beneath its burden.

Such is the nature of acute synovitis ; when its whole course is run. But it is to be understood that, at any period of the process, the disease may cease to advance and begin to subside ; spontaneously, or from treatment ; and that the symptoms will vary accordingly.

The disease may originate without any apparent *Cause*. More frequently it is the result of injury ; as bruise, or wound. In the latter case, unless union be effected by simple adhesion, synovitis is inevitable. For when the wound inflames, a portion of the synovial capsule inevitably partakes in that process ; and, as already stated, it is a peculiarity of that tissue that the inflammatory process, attacking a part, quickly spreads over the whole. Whence a plain and practical inference is to be drawn ; that in the treatment of wounds of joints, it is of the greatest moment to moderate the inflammatory process, and ensure simple adhesion.

Rheumatism is a frequent predisposing cause of synovitis ; the local disease being modified by the specific diathesis. And during the prevalence of this diathesis, a very slight exciting cause suffices ; or even this latter may be altogether wanting. The suppurative stage is seldom if ever reached, either in this form of the disease, or in that which is attendant on gout.

Exposure to cold often induces synovitis ; even in persons previously of the most robust health ; but most readily, of course, in those having a rheumatic tendency. And mercury, among its many evil results, often remote, is an undoubted, frequent, and prolific parent of some of the worst forms of synovitis ; at least, if not both predisposing and exciting cause, it is certainly the former.

The joints most liable to be attacked, are those of the extremities ; most exposed to external violence, and to atmospheric vicissitude ; the

knee, elbow, wrist, and ankle. On the whole, the first is the most frequent sufferer.

Treatment.—Treatment is early, active, and truly antiphlogistic. Blood is taken away copiously from the near vicinity of the inflaming part, by leeches or by cupping ; it being obviously of the utmost importance to check the process at its outset, or, at all events, to bring it down to a slower rate of progress, and to a minor grade of intensity. The tissue affected is endowed with both importance of function and delicacy of structure. After bleeding, therefore, the exhibition of calomel and opium is advisable ; as being most calculated, by its systemic influence, to save structure, and consequently retain function. Should circumstances render mercurialization inexpedient, or at least hazardous, full doses of aconite or antimony may be substituted. When the rheumatic diathesis is apparent, colchicum, with the salines, will be preferable to either—the former pushed, in full doses, till its physiological effect has been at least threatened, if not established.

The limb is encouraged to maintain the relaxed posture, voluntarily assumed ; and immunity from motion is anxiously secured, by gentle deligation of the part to soft pillows, skilfully and carefully arranged. Purgatives are inexpedient ; as opposed to immunity from motion. Should tendency to spasm prove troublesome, opiates are advisable ; and the combination of camphor with hyoseyamus, or belladonna will sometimes be found preferable. Fomentation is applied to the part ; regimen is low ; and, in short, all the ordinary details of antiphlogistic treatment are rigidly enforced.

In the great majority of cases, early seen and judiciously treated, the disease is arrested in its progress, ere the suppurative crisis has been attained. Then, as ordinarily happens in acute serous collections, the work of resolution slowly advances, almost spontaneously ; aid from treatment consisting merely in continued rest of the part, occasional fomentation, and maintenance of the spare regimen. Absorption is soon busy in clearing away the results, and, in most cases, is equal to the efficient completion of its task. But should it begin to flag, then it may be assisted from without ; by gentle friction, pressure, stimulating plasters or inunction, or the slighter forms of counter-irritation ; these, however, being always adopted cautiously, and as if with hesitation ; lest, by their premature use, the embers of a not yet extinct disease might again be lighted into flame.

When the inflammatory process has subsided, and its results also have been removed, motion is to be gradually restored ; at first passive and gentle, and always desisted from when pain is induced. Many a limb has been lost—for many a joint has suppurated—in consequence of reaccession of acute disease from imprudent resumption of motion. Some surgeons, while they forbid voluntary motion, yet forcibly alter the position of the joint during the acute progress of the disease ; on the ground that thus all subsequent awkwardness and deformity are more likely to be avoided. It is, doubtless, an object of very great importance, that the part's function should ultimately be restored ; that the limb should not be permanently bent, and the joint not permanently stiff ; but an over-anxiety to fulfil this indication may lead one to straighten

the limb, and move the articulation, too much and too soon. And, surely, the safer side on which to err, is to run some hazard of trouble even by threatened ankylosis, rather than to incur that of reinduced disease, and probable disorganization of the part thereby. It seems wiser to humour the natural position of the limb, during the acute stage ; and, when this has passed, to restore what is normal gradually and with caution. In effecting this, relaxation of the muscles will be obtained, and much pain and nervous irritation saved by putting the patient fully under the influence of chloroform.

When the inflammatory attack has fairly passed away, resumption of motion is imperative. For, even independently of other considerations, it is to be borne in mind that long continued immobility of a joint is, of itself, sufficient to cause serious structural change ; effusion of blood or serum into its cavity, fibrinous change of the synovial membrane, disease of the cartilages, and ankylosis.

Up to the time when motion is begun to be systematically restored, all movement in the joint is to be most studiously avoided. During the acute stage, the part is intolerant of bandages and splints ; then we have to trust to pillows, and gentle binding of the limb upon them. But so soon as the acute stage has passed away, so as to permit the application of splints, these are forthwith had recourse to ; being by far the most efficient means of fulfilling the all-important indication. A very suitable kind are those of thick leather, softened by immersion in hot water ; applied when pliable—usually one on either aspect of the limb ; retained, by bandaging, for a few hours, till they harden into a case closely adapted to the surface of the part ; then removed, and lined by some soft substance, such as tow, wadding, or chamois leather ; reapplied with moderate tightness, and constantly retained.

When, unfortunately, our efforts to arrest the disease have failed, and suppuration has occurred—the interior of the joint being, in truth, converted into an acute abscess—the general rules of surgery are not to be departed from ; an early and free incision should be practised. This, however, can only be had recourse to, when the symptoms are so very distinct as to leave not the slightest doubt of suppuration having occurred. To plunge a bistoury into the cavity of a joint, filled with serous or sero-purulent fluid, would be a most unwarrantable procedure ; rendering disorganization certain, where otherwise all might have been saved ; such fluids, and the change of structure which attends on them, being perfectly amenable to absorption—on arrest of the active process which caused them. When there is any doubt, therefore, as to the nature of the contents, we withhold the knife, for a time. If they are purulent, the natural process of pointing will soon disclose the real state of matters ; and then incision is unhesitatingly performed.

After incision, fresh inflammatory accession is inevitable ; and has to be guarded against accordingly. The maintenance of rest, with other local management, is if possible more assiduous than before ; and temporary resumption of general antiphlogistics will probably be expedient. Afterwards, our expectation is that the cavity will gradually contract and close ; as do other acute abscesses. But, on account of the peculiar

nature of the parts implicated, it is not improbable that such hopes may be disappointed.

As formerly observed, purulent formations not unfrequently form in the larger joints, in the latter stage of pyæmia. Such formations, however, are altogether different from ordinary abscess; not the disease, but only a symptom of one infinitely more formidable, under which latter the system has rapidly given way, and hopelessly. The complication by articular abscess does not cause, but probably accelerates dissolution—already very near. There is seldom time or opportunity afforded, therefore, for treatment of the local malady; even should this be deemed expedient. But if there should, general principles are still to be enforced; a free and dependent incision is made.

Chronic Synovial Disease.

This may be simple in its nature—chronic synovitis; or connected with and marked by the scrofulous or other cachexies—scrofulous, or gelatinous, and fimbriated degeneration of the synovial membrane.

1. *Simple Chronic Synovitis.*—It may be original or secondary. The inflammatory process may have been chronic from the first; or originally acute, and subsequently assuming the chronic form. The pain, heat, etc., are comparatively slight. Swelling is the prominent symptom. And now the peculiarities of bulging, dependent on the structure of the joint, come to be distinctly seen—a circumstance diagnostic between the chronic and acute forms of synovitis. For the superimposed soft parts sympathize but little, and consequently cause little or no obscuration of the synovial bulge. The membrane is thickened, dull in hue, increased in vascularity; and gradually changes its smooth internal aspect into a soft, pulpy, or villous surface. The cavity contains more or less of a serous fluid; either pure, or mingled with a small proportion of flocculent secretion. This has accumulated slowly; the parts have gradually accommodated themselves to its presence; and the process of distension is consequently attended with but little uneasiness.

Sometimes the process of accumulation is peculiarly indolent and painless; and yet tolerably rapid in its rise. The superficial soft parts are wholly uninvolved; the whole disease seeming to be the product of a suddenly occurring passive congestion of the synovial membrane, and limited to that texture. The fluid is entirely serous; and the form of the swelling is very decidedly influenced by the natural configuration of the joint. This condition is termed *Hydrops Articuli*. The knee is its most frequent seat. It is most apt to occur at or beyond adult age; and in those who have suffered from mercury.

Chronic synovitis, though not in itself urgent in its nature, is nevertheless fraught with danger by continuance. For, at any time, a slight exciting cause may suffice for the induction of acute inflammatory accession. Even supposing that this do not occur, structure is certain ultimately to be seriously changed by persistence of the present affection, chronic though it be; and that not only in the texture originally involved, but in others to which the disease may gradually extend—the

cartilages, and even the bones. In another point of view also, the affection is important ; when we remember how much more difficult of satisfactory removal, are the results of chronic than of acute effusion.

The prominent symptom, as already said, is the unequal, fluctuating swelling. There are also dull pain or uneasiness, some heat, and great limitation of motion ; the joint is more or less flexed, and the tendons of the flexor muscles gradually assume a rigid condition. The limb, by confinement, wastes ; and its muscles become altered in structure as well as in bulk.

When the disease is extending to other tissues, and formidable though chronic change of structure is in progress, the swelling often loses its lax fluctuating character. The thinner portion of the synovial contents is probably being absorbed ; thickening of the synovial membrane is taking place. The swelling, consequently, becomes more solid and elastic, less fluctuating ; the joint is more painful, and more abridged in motion ; and constitutional sympathy, before perhaps slight, now becomes considerable—tending towards the hectic type.

Chronic synovitis is seldom the result of external violence. More commonly, it follows exposure to cold ; or it may be attributed by the patient to some slight twist or strain ; and it most frequently occurs in those who have suffered by the venereal poison, by the mercurial, or by both. Rheumatism, too, is a fertile inducing cause.

Treatment.—Moderate local depletion, by leeching, may sometimes be advisable at first ; not so much on account of a remedial effect expected from itself, but rather to pave the way for the use of counter-irritation, on which the main hope of cure has to rest. The counter-irritants may be varied, according to circumstances ; blisters, in succession ; croton oil embrocation ; tartar emetic ointment or solution ; or an ointment of nitrate of silver, strong enough to produce a pustular effect by inunction—are some of the most common and suitable forms.

When the inflammatory process has fairly ceased, and all is quiet, then attention may be mainly directed to discussion. With this view, suitable plasters may be applied ; as the gum plaster, or the mercurial, or equal parts of both. Or pressure may be employed, either by simple bandaging, or by combination of this with plaster. The iodide of potassium may be used in the form of ointment, as well as given internally ; or a strong solution of iodine, either aqueous or alcoholic, may be pencilled on the surface. But, still, let the effects of these remedies be carefully watched ; lest over-stimulation be induced. And throughout the whole treatment let the paramount indication be—rigid maintenance of absolute rest in the affected part, by splints ; at first lightly applied, so as merely to prevent motion ; afterwards with tightness, in order by their pressure to assist in the favouring of absorption. In due time, by passive motion, cautiously increased, the joint's function is restored.

Constitutional management is not to be disregarded. Invariably, more or less disorder will be found in the system ; and rectification of that is essential to due advancement of the cure. If any peculiar cachexy exist, as is not unlikely, it must be met by the suitable remedies ; obstinate and lurking venereal taint, by an alterative and cautious mer-

curial course ; mercurial taint—the more frequent of the two, either single or combined with the preceding—by the iodide of potassium ; rheumatic diathesis, by colchicum, salines, etc.

In hydrops articuli, the most trustworthy remedy is iodine ; used both externally and internally. Should it fail, mercury, unless otherwise contra-indicated, may be cautiously tried in a similar way ; externally, in the form of ointment or plaster ; internally, as an alterative course, mildly and prudently given. Or the tartrate of antimony may be administered internally ; pushed, in almost as full and as frequent doses as for pneumonia. This, however, is a harsh remedy ; and not to be employed till others, more simple and more usual, have been tried and failed. Locally, acupuncture, with subsequent application of the exhausted cupping-glass, has been tried ; but the result has proved unsatisfactory. Lately, it has been proposed to treat the part as if it were a hydrocele ; to draw off the serum by tapping, and subsequently to inject a solution of iodine ; a practice not free of serious risk, and in regard to which the testimonies of experience are somewhat conflicting.

When the dropsical accumulation, however, is considerable, it may very appropriately be evacuated by means of the needle trochar, as a preliminary to vesication of the surface, for the purpose of exciting the requisite amount of irritation to modify the nutrition of the synovial membrane, and restore it to a healthy type. Effusion occurs after this procedure ; but under pressure it soon disappears, and with rest, and possibly the reapplication of the blisters, a perfectly satisfactory result is attained.

2. *Scrofulous Gelatinous Synovial Disease*.—This affection is accompanied with marked indications of the strumous cachexy ; throughout its whole course, as well as previously to accession. The membrane slowly thickens, degenerating into a gelatinous pulpy substance, soft, and of a whitish or light gray colour ; at first with merely an exaggeration of the ordinary secretion, slightly perverted in character—thicker and more opaque. The synovial membrane does not, however, alone suffer. The synovial fringes which surround the margins of the articular cartilages early become implicated in the process of cell multiplication which constitutes the essence of the disease ; and from them the disease invades the cartilaginous surface ; the delicate margin of the membrane dipping into the cartilage by a series of fine vascular serrations, formed from the transformation of the cartilage ; the hyaline substance becoming converted into fibrous tissue, the corpuscles by multiplication into granulation texture—so closely resembling the transformation which the synovial membrane has itself undergone, as to make it impossible to say where the original membrane ends and the transformed cartilage begins. But suppuration is not unlikely to follow, probably occasioned by acute inflammatory accession ; or, it may be, merely in accordance with the onward progress of the original disease. From whatever cause induced, the occurrence is quickly followed, as usual, by great aggravation of the symptoms, both general and local, and speedy disorganization of both cartilage and bone.

The symptoms differ from those of ordinary synovitis. The patients

are usually adolescents ; and evince, more or less strongly, the scrofulous cachexy. A slight injury, as a blow, strain, or twist, may or may not have been sustained by the part. The joint slowly swells, and has its motion more and more impaired ; but little or no pain is experienced. The swelling is soft, doughy, somewhat elastic, but totally devoid of anything like true fluctuation ; the integuments are pale, and scarcely tense ; and even free pressure and manipulation may be comparatively well borne. In this indolent condition, the joint may continue for months. But, failing gradual cure, suppuration usually supervenes.

During the progress of this disease—and, indeed, the observation may be extended to almost all serious and chronic structural changes of joints—the whole limb undergoes an atrophy ; hard textures as well as soft. The bones become more slender in their shafts, and of less density ; the ligaments are opened out in texture and softened, and thus permit an increased degree of lateral mobility of the articulation, or even spontaneous displacement of the articular surfaces, to take place ; the adipose tissue disappears by absorption ; the muscles grow flabby, pale, small, and weak ; and in the lower part of the limb, passive congestion and cedema are not unfrequent.

It may be here stated, also, that in many examples of diseased joint, in whatever texture morbid change may have originated, the advanced stage is often complicated by enlargement of the lymphatic glands ; sometimes indolent, sometimes active and prone to suppuration—occurring in the axilla, from diseased elbow, for example ; in the groin, from diseased hip or knee. The complication is a serious one ; and ought always to be taken into account, in both treatment and prognosis.

Treatment.—In the early stage, local treatment is the same as for simple chronic synovitis ; rest and counter-irritation. Constitutionally, the ordinary remedies are to be employed, whereby the system's taint may be most hopefully opposed ; and this anti-strumous treatment must be maintained, unweariedly, throughout. When the indolent condition has become thoroughly declared, pressure and rest constitute the principal remedial means.

These, indeed, are powerful agents of cure in all chronic affections of joints, however originated ; whether occurring in their hard or soft tissues ; but most hopeful in the latter case, as can readily be imagined. And there is every reason to believe, that to the more skilful, as well as more frequent use of these remedial means, the marked improvement in the treatment of diseased joints, in modern times, is largely to be attributed. Many an articulation is now saved, which formerly would have been unhesitatingly doomed to the knife.

Much credit is due to Mr. Scott, for having directed attention to the importance of this mode of treatment. And a modification of what is ordinarily termed "Scott's dressing," will be found a most valuable remedy for all chronic affections of joints, in the truly indolent stage ; more especially for those wherein the disease has not only originated in the synovial apparatus, but is still limited to that tissue. The limb having been uniformly supported by a bandage, from its extremity up to the affected joint, the surface of the swelling is covered by strips of lint, spread with some gently stimulating ointment—soap cerate with camphor,

for example, or that with a greater or less proportion of the unguentum hydrargyri. The whole articulation is then surrounded by long bands of adhesive plaster ; drawn with moderate and uniform tightness, so as to support, and firmly yet uniformly compress the parts, without producing absolute pain or uneasiness. Above all, splints are applied, to secure total immunity of motion ; and they may be of leather, of wire, of paste-board, or of wood—the first usually the most suitable. When this dressing has become loose, from subsidence of the swelling—as usually happens in a few days, when first employed, progress thereafter becoming more gradual—it is reapplied, as often as may be necessary. But should fresh excitement occur in the joint, from any accidental cause, this system of dressing must be discontinued, until such excitement has been subdued by the usual means ; and when pressure is resumed, it should at first be very moderate.

During treatment, the limb must be kept, or gradually brought into the most advantageous position for future usefulness ; particularly if from the nature, duration, and extent of the disease, there is reason to fear ultimate impairment of the joint's motion. Thus, by steady extension with splints, the knee-joint may be brought into nearly a straight position, so that it shall be serviceable in progression ; and the elbow may be bent so as to be convenient for prehension. By prudent yet persevering friction, and occasional passive motion, these desirable changes may be greatly facilitated. But all such alterations of stiffened limbs must be proceeded with very cautiously ; otherwise, they may occasion undue excitement, and consequent renewal of the disease.

The Fimbriated Synovial Membrane.—This affection does not always require surgical interference ; indeed, in its slighter forms, it may be considered as a mere variety of the normal condition. According to Mr. Rainey, those parts of a joint, theca, or bursa, least exposed to pressure, are provided with a peculiar disposition of the synovial apparatus. Loops of capillaries, of various degrees of complexity, project into the joint, covered by synovial membrane, disposed in the form of “sacculi” or villi. “From the sacculi enclosing the capillaries, numerous other sacculi, into which no capillaries enter, proceed : these are of various forms and sizes, but generally they are attached to the primitive sacculus by an extremely long and slender filament of fibrous tissue, resembling the petiole of a leaf, the secondary sacculus resembling its expansion. Sometimes there are several series of these sacculi attached one series to another, exhibiting an arborescent appearance ; but in every instance the secondary sacculi are extra-vascular.”*

These fringes of synovial membrane, though long known to anatomists, have received too little attention in connection with morbid conditions. It is nearly certain that the disease now under consideration consists in the mere hypertrophy of these ; and in some cases they appear to become the seat of abnormal fibro-cartilaginous or bony tissue. According to Mr. Rainey (*loc. cit.*), it is by the detachment of them when thus transformed, from rupture of their narrow pedicles, that many of the loose bodies in joints, hereafter to be noticed, are produced.

* Monthly Jour. May 1849, p. 747 ; Quain and Sharpey's Anat. Introd. p. cclxxiii.

The following is Mr. Liston's description of this affection in its advanced condition. "The synovial membrane may be studded, on its inner aspect, with pendulous substances projecting into the cavity of the joint; sometimes of almost cartilaginous consistence, but more frequently of a fatty appearance. The entire surface of the membrane is occasionally covered with these bodies, which are of a white or yellowish colour, and very variable in size and shape; the smallest presenting the form of villi not much larger than those of the jejunum, the largest having somewhat the magnitude and appearance of the appendices epiploicæ of the large intestine, while many of an intermediate size approach in appearance to a lemon seed. In some instances the membrane is only partially pervaded by them; and sometimes, they are arranged like a fringe around the edge of the articulation. They are generally very smooth on the surface; which appears to be perfectly continuous, if not identical, with the synovial membrane. Their attachment is sometimes broad, sometimes very narrow and pedunculated, often merely filamentous; so that a little further thinning of the part, or slight force acting on the body, would remove it from the capsule, and throw it loose into the cavity of the articulation. The disease has been most frequently seen in the knee, and sometimes in the elbow.



Fig. 145.

"The affection is obscure in its nature, and slow in its progress; the joint is the seat of pain after and during exercise, probably from the abnormal processes interfering with motion of the articular surfaces. As the disease advances, the joint becomes swelled and elastic; unattended, generally, by ulceration of the tissues within or around it. In examining the part, when the articular surfaces are moved on each other, it will be found that their motion is more or less interfered with; and considerable irregularity in their action may be felt, by the hand placed firmly on the joint during the procedure."* In many cases these developments constitute a part of the changes in an articulation included under the name bestowed upon them by Mr. Adams of "chronic rheumatic arthritis."

Disease of Cartilage.

Loss of substance may take place in cartilage, by either a rapid or a slow morbid process; and either with or without disease of the other structures involved in the joint.

It is now well understood by physiologists, that nutrition of the textures takes place according to the laws and powers inherent in the essential elements of those textures themselves; and that the blood-vessels are only in so far subservient to the act of nutrition, as they furnish to the texture the materials for its renewal. The power of im-

* Liston's Elements of Surgery, p. 89.

bibition possessed by these textures themselves, and the vital properties with which they are endowed, form the essential parts of this process ; and it is sufficient if the nutritive fluid be carried by its vessels into such a degree of approximation with the minuter elements of the tissues, as shall admit of the imbibition by them of an amount corresponding with their nutritive activity. In the former chapters of this work it has been shewn, in conformity with these views, that the different morbid processes taking place in the textures are mostly to be regarded as perverted forms of their nutritive changes, and consequently dependent only in a secondary degree on the nature and amount of the vascular supply.

Mr. Goodsir has led the way to the true pathology of articular cartilage, by shewing that the disintegration of these structures is accompanied by changes in their minuter organization, which cannot be accounted for on physical principles, and must be the result of inherent though perverted nutritive activity in the tissue itself. Cartilage is composed, as is well known, of corpuscles contained in cells implanted with a certain order and arrangement in an apparently homogeneous intercellular substance, which has been called the *matrix*, hyaline substance, or intercellular substance. Mr. Goodsir has pointed out, that disorganization in cartilage is invariably accompanied by changes in the form and size of these cells,

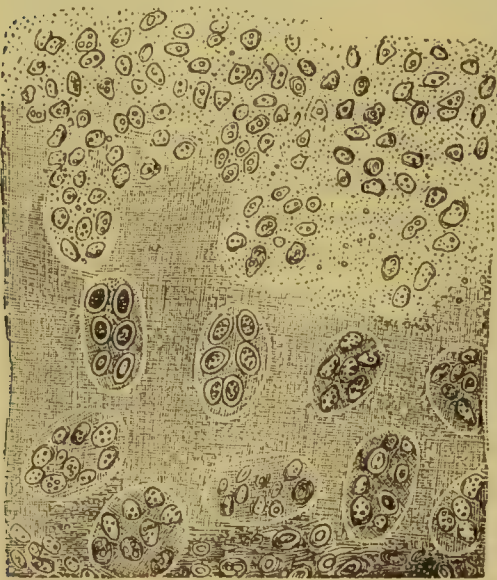


Fig. 146.

which become much enlarged, and more rounded than in the normal state ; “and instead of two or three nucleated cells or corpuscles in their interior, contain a mass of them.” At the same time the matrix softens and breaks up, being probably absorbed in part into the enlarged corpuscles, the more superficial of which have their walls destroyed, and their cellular contents set free. In the course of these changes, the cartilage remains entirely non-vascular ; but as it gradually disappears, the exposed surfaces are very commonly occupied by a fibrous membrane, which lies everywhere in close apposition with them, and is pervaded

by new vessels derived from the vascular system of the adjacent bone or synovial membrane. Sometimes this fibrous structure is also formed between the cartilage and the bone—in room of the articular lamella, which has undergone transformation ; and in this case destruction is found to be in progress, both at the attached and free surface of the cartilage. The apparent vascularity of cartilage in disease, therefore, seems to depend altogether upon a transformation into fibrous tissue.

Fig. 146. Diseased articular cartilage magnified 240 diameters, shewing the enlargement of the corpuscles, the more superficial of which are throwing out their contents into the softened intercorpuscular substance.—REDFERN.

Dr. Redfern, late of Aberdeen, in his excellent memoir on the morbid processes in the articular cartilages, gives numerous examples of the changes in the cells mentioned by Mr. Goodsir; and also of the formation of the vascular membrane above adverted to. Dr. Redfern has likewise investigated very closely the changes taking place in the matrix or intercellular substance. This, which in the normal state is of homogeneous aspect and nearly structureless, appears under the influence of disease to split up into bands and fibres; and these are often found, in partially and slightly diseased joints, giving a soft and velvety aspect to the surface of the cartilage. As the disease proceeds, the altered hyaline substance becomes full of corpuscles, which are the result of the bursting and discharge of the cell contents; and these two elements combine to form the fibrous and vascular membrane which is found in contact with the cartilage in such cases. This membrane is not, therefore, as Mr. Key supposed, the agent of disintegration, but the result of it.

The nuclei of the cartilage cells are not unfrequently, according to Dr. Redfern, converted into fatty granules; but the most important change is their elongation and transformation into fibres, by being incorporated with the altered hyaline substance.

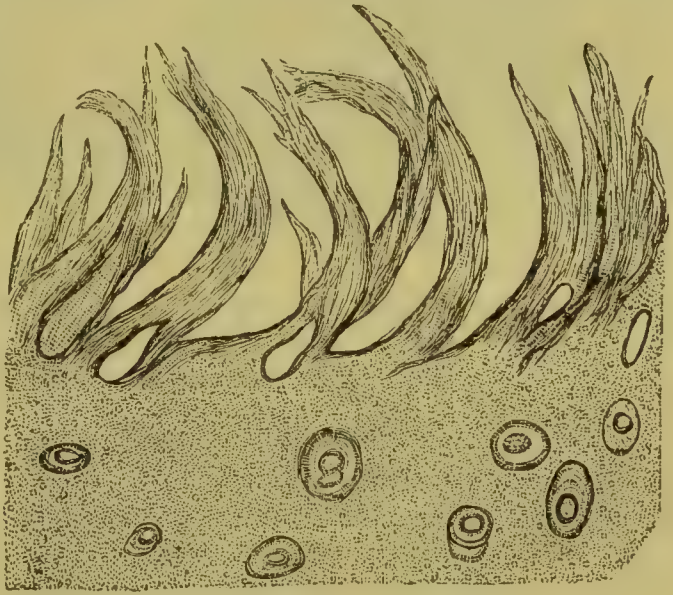


Fig. 147.

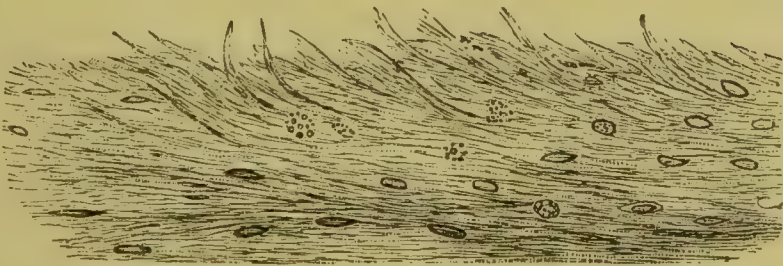


Fig. 148.

Another change occurring in many diseased cartilages is the infiltration of them with amorphous mineral matter, chiefly phosphate of lime;

Fig. 147. Microscopic view of a perpendicular section of articular cartilage, shewing its surface occupied by fibrous bands formed by the splitting of the hyaline substance. These bands rendered it velvety in appearance to the naked eye.—REDFERN.

Fig. 148. Fibrous tissue with included cells and nuclei; formed, as above described, on the surface of the cartilage of the patella.—REDFERN.

which probably forms, when abundant, the porcellanous alteration to be afterwards described.



Fig. 149.

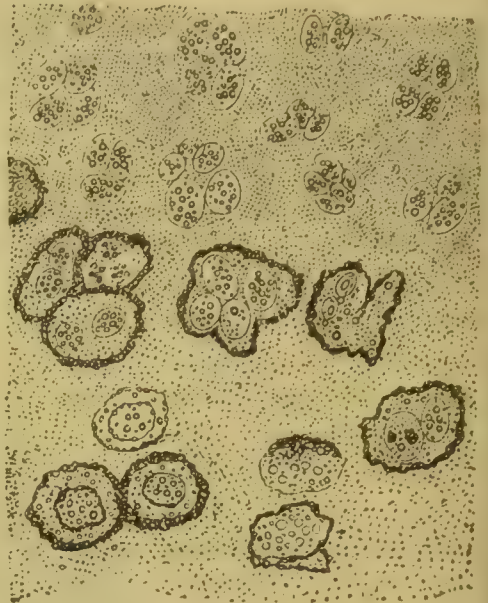


Fig. 150.

Ulceration or Destruction of Cartilage.

This may be a sub-acute or chronic process ; leading to little pain, or perhaps none, if the cartilage alone be involved ; unattended, at least in the first instance, by any purulent or even puriform secretion ; and giving rise to no swelling. This state of matters, while confined to the cartilage alone, may, we believe, exist without symptoms for weeks or even months.

The characters of the disease thus established may vary according to its extent. When recent and limited, it is often of a circular form, and seeming as if a chemical erosion of the tissue had there occurred ; without any sign of attempted repair. The affected surface is usually villous or velvety, even to the naked eye when floated in water ; and under the microscope shews the bands and fibres arising from the splitting hyaline substance. When the affection is very superficial, much of the cartilage may present this character without any other mark of disease. When, however, the morbid process involves other textures, symptoms of a severe character become developed. The bone may have been laid bare, or disease may be lighted up in the synovial apparatus ; an accute inflammatory process ensues ; pus is formed from the rapid multiplication of the cartilage corpuscles, and transformation of the granulating synovial membrane and osseous tissues, should they be affected ; destruction of the cartilage in a more rapid form is accordingly established, accompanied with pain, swelling, and fever.

The destructive affections of cartilage, attended by characteristic

Fig. 149. Vertical section of cartilage in a diseased knee-joint, shewing the cells enlarged, granular, and bursting. On the right, and above, their contents are seen mingling with a fibrous and granular mass which occupies the surface.—REDFERN.

Fig. 150. Deposition of opaque calcareous matter, commencing in the walls of the cartilage cells.—REDFERN.

symptoms, may be said practically to originate in one of two ways. It may follow on chronic serofulous or gelatinous degeneration of the synovial membrane, or it may be the result of disease in the cancellated texture of the articulating extremities of the bones ; at first chronic, ultimately acute and rapid in its destructive progress. In the former case, there are at first the ordinary symptoms of the indolent serofulous degeneration of the synovial membrane, specially characterized by swelling and stiffness of the articulation. When, however, the cartilage, as already described, becomes converted into a fibro-vascular granulation texture, like the synovial membrane, interposed between the bones, deep seated pain, especially severe at night, accompanied by spasmodic starting of the limb, supervenes. The swelling increases from effusion taking place into the joint ; or, where the cavity of the joint has become obliterated by the previous gradual progress of the disease, from rapid cell formation. This change is attended by local inflammatory symptoms of an acute or sub-acute character. Suppuration follows in one or more situations, and finds its way to the surface, often burrowing widely beneath the skin before it is evacuated. In the process of disorganization which follows, all the textures are more or less implicated, and with this the system suffers from fever of either an acute inflammatory or irritative type, which gradually, however, subsides into hectic. Should the articulating surfaces, during this change, have passed free of each other from spontaneous displacement, the pain and irritation begin to abate ; and the result, if the articulation is left to itself, will either be gradual exhaustion from hectic, or gradual diminution of the discharge, consolidation of the parts, and recovery of the patient with a shrunken, more or less useless, and distorted limb.

When the morbid change in the cartilage is determined by disease commencing in the articulating extremities of the bones, the alteration in the affected cancelli is the same as already described as constituting the morbid anatomy of simple osteitis, serofulous osteitis, and caries. When the cartilage, as well as the articular lamella on which it rests, has been destroyed by this ostitic change, the subjacent bone is exposed, and converted into medullary or granulation substance. Around this the cartilage is irregularly disintegrated, and through it a red papilla or vascular granulation peeps, continuous with the surrounding cartilaginous structures, and with the transformed osseous substance beneath. The synovial membrane, in the immediate vicinity, is often sympathetically involved, like the conjunctiva around a cornea affected with acute ulcerative *keratitis*, and appears red, swollen, and pulpy—especially in its plicæ vasculosæ ; and when the affection is progressing near the synovial margin, or the disease in the bone is rapidly and acutely advancing, the synovial membrane will be observed plainly to be undergoing inflammatory change of structure. The parts most prone so to suffer from this form of disease of cartilage are the inside of the head of the tibia and the corresponding points of the condyles of the femur, the head of the humerus, and the acetabulum.

Healing of the ulcerating cartilage may occur in different ways, but in no case is there any reproduction of true cartilage. 1. In the superficial and limited forms, the surface of the cartilage remains permanently depressed, and somewhat rough and villous ; with the edges of the

erosion more or less bevelled and smooth. 2. When destruction is more extensive, the chasm may be partially filled up by a fibrous cicatricial structure. 3. When disintegration has penetrated to the bone, the cicatrix is formed, in some cases, by this texture, and osseous nodules occupy the exposed part. These do not rise so as to fill the chasm, but remain limited and low, becoming smooth, and rounded off or porcellanous on their surface. 4. Or there may be no depression, there having been no destructive disintegration. The place of the cartilage has simply been taken by a hard amorphous substance, like ivory, which presents a surface as smooth and fine as porcelain. This, though wanting the elasticity of cartilage, is yet a wonderfully efficient substitute. 5. Or the healing process may be of a fifth kind. Often deep erosions of cartilage exist at opposite and corresponding points of the articulation. From these, fibrous or osseous reproductions coalesce, causing fixity of the joint by ankylosis.

Sometimes death of cartilage, in continuous mass, complicates and aggravates the process of disintegration. In such cases, doubtless, the initiative has been in the subjacent bone—or, rather, in the articular lamella, which, becoming rapidly disintegrated, leaves the cartilage loose and undermined—like skin sloughing after ulcerative destruction of its subjacent areolar tissue. By continuance of the loss of substance beneath, the dead portion is ultimately detached by marginal separation; and, becoming loose in the joint, adds to the mischief already there the stimulus of extraneous matter within an inflamed and suppurating cavity.

The *symptoms* of such change of structure in articular cartilage are very distinct from those of affection of the synovial membrane. With ordinary care, they need never be confounded. As already stated, in the advanced stage of joint-disease, when all textures are involved, it may be difficult to tell from present symptoms the original and chief seat of the malady; but while the morbid process is advancing in one texture, and as yet limited to that, the diagnostic signs of its presence and nature are usually plain enough. Be it remembered, however, that the symptoms of destruction of cartilage, although indicative of that pathological change, are not always a test of its amount, because not uniformly proportioned to it. They rather indicate the amount of disease in which the other textures of the joint have become involved.

The symptoms are found to accord with the chain of pathological events formerly stated. At first there is dull uneasiness in the part—and sometimes hardly that—with some impairment of motion; but without swelling or other apparent change of structure. This state may continue for days, or even weeks, with but little change. Then the uneasy feelings become more marked, and are aggravated nocturnally. When bone is reached, by perforation, or original implication,—or synovial texture, or perichondrium, by lateral extension—the pain is undoubted; deep, constant, worst at night; sometimes referred by the patient to one particular spot deep in the joint, and likened to the unceasing gnawing of an animal there. Acuter pain comes with the advance of the inflammatory process towards its crisis, and keeps pace with it. It is aggravated by motion, more especially if great and sudden; and, on gentle movement of the part, a grating sensation is ultimately perceived, in consequence of exposure of opposing points of bone. Very frequently sym-

pathetic pain is complained of, sometimes predominating over that in the part—an example of irritation in one locality, induced by inflammatory change of structure in another; pain in the knee, for example, is usually the most prominent symptom of disease in the hip; and pain in the leg may mask destruction of the cartilages in the knee. The whole of the limb beneath the affected joint is usually both functionally and vitally weak; feeble and tottering; of diminished temperature, congested, and inclined to oedema.

Wasting of superimposed muscle is often both a prominent and an early symptom of articular disease; atrophy of the deltoid, for example, along with pain, will at first be all there is to betoken disease of cartilage, of bones, or of both, in the shoulder; and flaccidity of the glutei does the same in regard to morbus coxarius. In the child, however, we must be on our guard against mistake on this point; inasmuch as muscular atrophy over joints not unfrequently occurs in early life, altogether unconnected with articular disease; dependent on dentition, or on intestinal irritation. This atrophy of muscle, around such a joint as the knee or elbow affected with disease of the cartilaginous surface, gives it the appearance of enlargement in the articulating extremities of the bones. There is however no real enlargement at this stage of the disease; though from inflammatory change the soft parts around the ends of the bones become agglutinated together, giving a smooth oval aspect to the general outline of the articulation.

Swelling—not appearing till uneasy sensations have been present in the joint for some considerable time; weeks, perhaps even months—then follows the steady aggravation of pain, which indicates the advance of the disease; and is both less bulky and less rapid in its formation, than that which attends on synovitis. It is composed of two parts; one internal, caused by gradual distention of the synovial pouch by slowly accumulating fluid; the other external, from the inflammatory product in the textures exterior to the joint, these being now involved in a tolerably active sympathetic affection. In consequence of its double and gradual nature, the peculiar bulgings dependent on the natural conformation of the joint do not occur; a diagnostic mark between this affection and chronic synovitis. In acute synovitis, swelling is tolerably uniform; but at the same time it is great, rapid, and coeval with the occurrence of pain; whereas in destruction of cartilage, it is slow, gradual, never so



Fig. 151.

Fig. 151. Wasting of muscles shewn, with the apparent elongation of limb, in the first stage of disease of the hip-joint. The muscular deficiency is but imperfectly represented; the change of natal fold, resulting from it, is however sufficiently apparent.

great, while suppuration has not taken place and an abscess not formed, as to make the measurement of the joint greater than that of the corresponding sound one—and it comes on at a period long subsequent to the feeling of uneasiness in the part. In chronic degeneration of the synovial membrane, on the other hand, the swelling is early, slow, and somewhat uniform; elastic, doughy, and superficial—not deep and obscurely fluctuating, like that which attends on affection of the harder tissue. The latter swelling, too, is intolerant of pressure, pain being thereby much increased; while the other, on the contrary, so long as suppuration is not impending, is capable of bearing manipulation with comparative impunity.

When swelling has become fully established, the disease is no longer limited to the cartilage; it has involved all textures. Pus accumulates; change of structure takes place in the synovial membrane and textures exterior; the ligamentous apparatus relaxes, and the joint becomes preternaturally loose; and, if moved freely, grating of the articular osseous

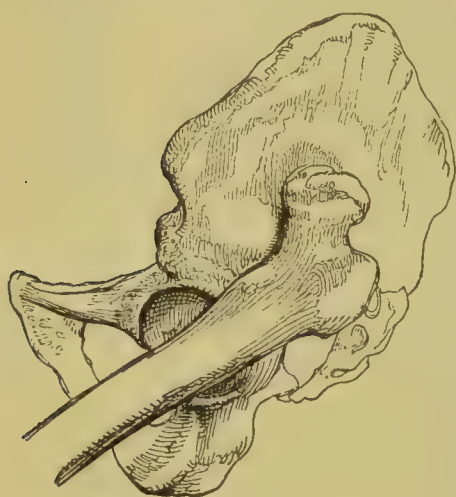


Fig. 152.

surfaces is felt, and intense suffering occasioned to the patient; ultimately the capsule gives way, and the fluid escapes from the joint, frequently by a small aperture, but collecting in quantity external to the joint, makes its way to the surface, and is thence discharged. In consequence of this increased laxity, the joint, which previously may have assumed the position of semiflexion, may become wholly luxated; the flexor muscles having then to encounter but little opposition to their displacing force; and ordinarily there is also more or less rotation, or other displacement; one

muscle, or set of muscles, exerting a supremacy of power. Thus, in such affection of the knee, the bones of the leg are dislocated backwards into the popliteal space; and at the same time the head of the tibia is usually rotated outwards, by the preponderating action of the biceps flexor cruris.

Such important local changes are not unattended with sympathy of the system. At first the constitutional symptoms may be but slight; little more than general discomfort, or slight feverishness, being complained of. But when pain becomes undoubted and steadily crescent, inflammatory fever is declared with more or less intensity; usually accompanied by involuntary startings of the affected limb—especially during sleep—by the jarring and motion of which the pain is fearfully aggravated, and the inflammatory process hurried on in its destructive tendency. Ultimately, in the open, lax, discharging, perhaps dislocated state of the part, hectic is inevitable.

The *results* are various. Resolution may occur, at an early period of the process; the disease having given way to rest and counter-irritation, without any morbid products having been poured out, and with only slight and superficial destruction. Or disintegration, having occurred,

Fig. 152. Luxation of hip, in consequence of morbus coxarius.

may prove but slight and transient, and function may be restored ; the breach being closed in one or other of the ways already noticed. Or osseous reproduction may prove excessive, occasioning true ankylosis ; the limb being retained, but permanently maimed in the function of its articulation. Or the inflammatory destruction of the osseous textures, attended by ulceration and articular caries, may ultimately become both so general and so great, and the constitutional sympathy so formidable, as to banish all hope of saving the part, even with impaired form and function ; compelling us to direct our attention solely to the saving of life by excision or amputation. The joints most prone to suffer are the hip, shoulder, knee, ankle, and elbow ; but any articulation may suffer from this form of disease, even the vertebral articulations and sacro-iliac synchondroses.

The affection may be idiopathic. More frequently it is attributed to external injury ; perhaps slight ; probably neglected. Exposure to cold, too, is favourable to its induction ; as are the rheumatic, gouty, mercurial, syphilitic, and scrofulous taints of system. The former causes are more frequent in the adult, the last at an early age and in adolescents.

Treatment.—When the disease is only commencing, the hot douche will be found in many cases sufficient to cope with it successfully ; but in more severe and advanced cases the obtaining of complete immunity from all motion, by the adaptation of splints, must be the paramount indication from the beginning to the end of the cure ; and next in importance ranks counter-irritation on the surface. The vesicant form we found to be most suitable for affections of the synovial membrane. In this disease, a higher grade, the pyogenic, is required. Issues are the form generally in use ; and they may be established by either the potential or the actual cautery. The latter, as being more powerful, and not more painful, gave in its first application, is usually preferred ; except in cases where the destruction of the cartilage has commenced in disease of the synovial membrane, when it is certain to aggravate matters, and probably hurry on suppuration. The cure is generally tedious ; and, consequently, the counter-irritation and other means require to be patiently continued. For some time, often considerable, the irritation and discharge must be continued from the surface ; and this may be effected in one of two ways, either by forming a succession of fresh issues, or by maintaining an open state of the one originally made. The latter method is most commonly followed ; equally effectual with the other, less troublesome to the surgeon, less painful to the patient. The discharging surface is dressed from time to



Fig. 153.

Fig. 153. Shortening, swelling, deformity, lameness ; the advanced stage of morbus coxarius.

time with some irritating ointment or lotion, or may be touched occasionally by potass or other caustic. This last mode of refreshing the sore is probably the best ; the inflammatory reaccessions, thereby induced in the surface, being of service, as well as the maintenance of sufficient purulent discharge ; it being generally our object, in these cases, not to obtain either counter-irritation or evacuation alone, but a combination of both. Also, let us at all times beware of placing the artificial sore too near the joint ; otherwise we shall fail in counter-irritation, and apply a direct stimulus to the disease. And in cases which tend to retrograde after a temporary change for the better from the use of the cautery, the induction of cicatrization of the open issue may be attempted with advantage. Constitutional treatment is at the same time employed, according as circumstances may demand. When much pain and spasm exist, full opiates are indispensable ; and remedies may with great advantage be employed, especially in the early stage of the disease, adapted to influence the constitutional condition which predisposes to the diseases of the joint. Calomel and opium, colchicum, and iodide of potassium, are serviceable in many rheumatic, gouty, and syphilitic cases ; while cod-liver oil and iodide of iron may be given advantageously in the scrofulous form. In all, tonic remedies and a richly nutritious regimen will be required, after suppuration has taken place, and hectic become established.

In the more favourable cases, such treatment is slowly followed by gradual amendment, even though considerable progress may have been made in the process of destruction ; the pain abates, and ultimately ceases ; the constitutional symptoms also disappear ; swelling yet remains, but softer, indolent, and less painful on pressure. When this state of quiescence has been reached, counter-irritation is to be desisted from. The issues are allowed to heal ; the splints are retained, still to control motion ; and pressure, by the method formerly mentioned, is had recourse to, to hasten absorption and consequent return to the normal state. At first, however, pressure must be applied with especial caution, lest acute accession ensue ; and if this threaten, the original treatment must be at once renewed. When not only the inflammatory process, but its products also, have been removed, motion is restored ; but hardly till then ; passive at first, gentle, and brief. A certain degree of uneasiness may always be expected on resumption of motion, however cautiously conducted ; but that is not to deter from perseverance in its use. Only when the sensation is that of undoubted pain, deep and constant, not in any marked degree diminishing on cessation of the motion, are we warned of danger ; and such warning we are never to neglect. The splints are resumed ; along with leeches and counter-irritation, if need be ; and all movement is as scrupulously avoided as at first ; otherwise back will come the ravages of renewed disease, perhaps in an aggravated form. Such intercurrent inflammatory accessions are by no means unfrequent ; and not always the result of malapraxia—sometimes supervening without any assignable cause.

When we are satisfied that suppuration has fairly taken place, and that destruction of cartilage as well as of other textures is advancing rapidly, we need not fear to carry out the general principles of our art by free evacuating incision. It is the only practice capable of affordin

immediate relief, or of retrieving in any degree the disaster already incurred.

In the open condition of the ulcerated joint, cure is by no means hopeless. The probability is that motion will be permanently impaired to a certain extent; but we have usually good hope of retaining the part; amputation, now-a-days, being not the rule but the exception, even in this class of cases. After the establishment of the open state, not unfrequently the disease advances with increased virulence for a time, as formerly stated; and this exacerbation, expected, is to be met and subdued in the ordinary way. Afterwards, by rest, constitutional treatment, and, if necessary, counter-irritation—in addition to the evacuant remedy which has spontaneously formed—the quiet condition is attained. And then the treatment by compression will often be followed by the happiest results; subsidence of swelling, gradual disappearance of all uneasy sensations, closure of the apertures, and diminution of the discharge. The compressing apparatus is applied in the ordinary way, and does not require unusual frequency of renewal; the discharge in the truly quiet condition of the joint—to which state alone such treatment is applicable—being inconsiderable, and not tending to accumulate injuriously beneath the dressing. Under such circumstances, however, it is expedient to extract all mercurial ingredients from the ointment and plaster, otherwise a constitutional influence may be induced unnecessarily; the open state of the part being very favourable to absorption. After satisfactory amendment under the compressing plan, motion is to be cautiously attempted. In some cases, we may succeed in restoring it completely; in others, it is incomplete, partly from alteration in the joint itself, partly from structural change in the ligamentous and other apparatus exterior. In not a few cases, motion is scarcely if at all regained, true ankylosis having occurred.



Fig. 154.

In some cases—but more particularly in the scrofulous destruction of cartilage and subjacent bone—there is no hope of cure, even by ankylosis. The disease will, as it were, accept of no compromise. If the part be accessible—as the elbow—it is to be removed by the knife, ere yet the system have been irretrievably involved in the downward progress; if inaccessible,—or supposed to be so, as in some affections of the hip (unsuitable for resection)—we must be content to palliate what we cannot cure. The constitutional symptoms are to be met by the ordinary means. Locally, neither counter-irritation nor depletion are to be thought of; but rest is all important. By the skilful adaptation of splints, so as to secure immunity from motion, yet without galling the part or annoying the patient, and not interfering with facility of dressing requisite for cleanliness, much comfort is obtained. Life is not only made infinitely more tolerable, but may be protracted for even a considerable period. Even in the most hopeless cases, decided benefit will not fail to shew

Fig. 154. Destruction of cartilage, in the knee-joint.

itself—at least for a time ; and in some, at first apparently irremediable, the amendment may be both so marked and so sustained, as not only to warrant the entertainment of a hope of cure, but even to carry that out to a tolerably successful issue ; the joint may dry, and stiffen, and be consolidated—both life and limb retained.

In any case of urgency, whose circumstances point to early amputation, it behoves us to consider, before determining on that extreme measure, that it is possible the counter-irritant treatment may have been carried too far, and that this may be the cause, at least in part, of both the local and constitutional aggravation. Accordingly it is expedient, in the first instance, whenever circumstances permit, to abandon all active treatment—allowing the issues to heal, maintaining absolute rest of the part, giving due regard to the general health, and letting an interval of repose declare whether the urgency has arisen from the progress of the disease, or from excessive action of the means of cure. If the issues have been in fault, the symptoms will satisfactorily subside, during this interval ; amputation, in consequence, is not only deferred, but may be rendered altogether unnecessary. If, on the other hand, no amendment follow, amputation or excision is unhesitatingly performed.

In those scrofulous and cachectic cases in which it is plain the part cannot be saved—and unfortunately these do not constitute the minority—removal of the joint by either amputation or resection is naturally looked to as the only source of hope ; that by a sacrifice of a part, a mutilated whole may still be saved. But careful inquiry and reflection are necessary ere this resource can be duly determined on ; otherwise it may happen, that by removal of a part we do not succeed in preserving the whole, even for a time, but on the contrary greatly accelerate its decay. It may be that the frame is irrevocably the victim of the tubercular cachexy, and doomed sooner or later to perish thereby ; but for the time it is relieved by the breaking out of a drain or safety valve in the suppurated joint, whereby the injurious deposit is with comparative impunity prevented from occurring in internal parts ; exhausting the system in one sense, it is true, and inducing marked hectic, under which vital power must ultimately be prostrated ; but still keeping back the more formidable obstacle to life by disease in an internal organ—lungs, liver, kidneys, or all. Such deadly internal disease may be only threatened as yet ; and the open joint may delay its invasion. Or even should the phthisis be already plain, the local discharge, if free and constant, may moderate its onward progress. Whereas, should the operation be performed, and should the wound dry and heal, the probability—nay, almost the certainty is, that the internal and more serious disorder will sustain a mighty and altogether uncontrollable aggravation, and, inducing a far worse form of hectic, hurry the patient fast into the grave. With the open joint, he might have lived for months, in comparative ease ; without it—supposing the operation to be in all respects locally successful—days, or weeks at most, will see his doom complete. Ere operation is definitively resolved on, therefore, let there be a careful review of the patient's past history and present circumstances ; let the state of the internal organs—more especially of the lungs—be diligently inquired into ; and if these appear free from tubercular disease, as well as from

strong predisposition to it, let the operation be undertaken, hopeful of success ; but if, on the contrary, the internal organs be plainly already involved, and that seriously, let us by all means refrain from operating, and content ourselves with palliation of the more distressing and urgent symptoms. When there are strong marks of predisposition, but yet no decided evidence of the internal disease, expediency of operation is at all times doubtful ; and the question can only be rightly resolved by the deliberate use of judgment and experience. Should amputation be performed, immediate union of the wound by adhesion is plainly not desirable ; for sudden drying up of the long continued discharge might seriously incommode the system. We seek suppuration and granulation, and, by that mode of healing, have a gradual transition to local soundness. When, however, the disease of the joint is a source of great suffering, with loss of sleep and appetite, and the patient is obviously dying unless relieved from its irritation, the operation may then be undertaken without regard to the presence of incipient disease elsewhere. In such circumstances, disease of the lungs has been arrested, and serious disease of the kidney has not proved fatal ; while in other cases the confinement to bed which the disease of a joint has required, has apparently induced disease of internal organs, a result which a timely operation might have prevented.

In those cases in which cure is slowly advancing by ankylosis, it is very important, with a view to the future usefulness of the limb, to have regard to the position of the joint. In the elbow, for example, we prefer neither complete extension nor extreme flexion, but an intermediate angular position ; the limb, when so fixed, being most favourably disposed for prehension. The spontaneous flexion of the knee, on the contrary, will be gradually undone, and yet full extension not desired ; the limb when slightly bent, so as to permit weight to rest on the ball of the foot, being in the posture best suited for progression.

When cure has resulted with fixity of the joint, whether in a favourable position or otherwise, a question arises as to the propriety of attempting to overcome the rigidity, and restore motion. When ankylosis is osseous and complete, the question may be unhesitatingly answered in the negative. Disruption of the osseous union could only be effected by such violence as must inevitably reinduce the inflammatory process, probably of a grave kind, in a part whose power of control has been greatly impaired by previous and recent disease ; the process of disorganization advances anew, and the joint is lost.

Still a question may arise, whether or not a joint thoroughly ankylosed is beyond the reach of our remedial art. In the case of the elbow this is easily answered ; excision of that joint for ankylosis having been both frequently and most successfully resorted to in this city. In the case of the shoulder-joint, the mobility of the scapula renders any interference unjustifiable ; in the case of the knee, rigidity being better there than mobility, excision could not be of the slightest benefit. The case of the hip-joint alone remains for consideration. All the textures enjoying a complete immunity from inflammatory disease and tendency, may not an incision be made immediately beneath the stiffened joint, the bone there sawn across, and the case subsequently treated so as to establish a

false articulation—inferior doubtless to the original, yet still capable of assuming at least some of its functions and utility? This has been practised by Mr. Barton, of America, with success; section of the neck of the femur having been performed for the relief of ankylosis of the hip-joint. Further experience would assuredly be required, however, ere such procedure could be said to be as expedient in practice as feasible in theory.

Hypertrophy and Atrophy of Cartilage.

Articular cartilage, like cuticle and other non-vascular tissues, may become preternaturally developed, or diminished in bulk, either generally, or only at certain points. The parts most prone to undergo enlargement are those where pressure is habitually the least; as on the patella. The free surface is often less smooth and polished than in the normal state; dull, yellow, and almost villous in its aspect. When examined with the microscope, multiplication of the corpuscular elements of the cartilage will be found taking place, with amyloid degeneration even manifested by the application of iodine to the portion under examination. The affection may occur at any age. The symptoms are obscure; dull uneasiness, perhaps a very slight degree of swelling, impairment of motion, and a feeling of weakness in the part. The treatment will consist of rest, with the minor forms of counter-irritation; and the iodide of potassium is likely to be of use, given both externally and internally. Afterwards, friction, and support of the part by bandaging, or by an elastic close-fitting “cap,” will be advisable.

Atrophy of cartilage, again, occurs chiefly in the old, at the points habitually most compressed; and the aged who have led a laborious life, much in the erect posture, are the most prone to suffer. It is, in fact, one of the changes which, taken as a whole, has of late years received the name of Chronic Rheumatic Arthritis. The joints of the lower extremity, especially the knee on its inner part, are the most frequently affected. It is with difficulty distinguished from the slighter forms of destruction already described. At first the cartilage seems to be opened up in texture; afterwards the normal density is resumed, but with diminished bulk. The cartilage may be merely thinned, in stripes or patches, continuous or detached; or it may be wholly removed, exposing the subjacent bone. This latter tissue, however, usually remains entire; giving way neither by absorption nor by ulceration, but tending, on the contrary, towards a reparative effort. The symptoms are, like those of the opposite condition, obscure; rigidity, creaking sensation and noise in attempted motion, rheumatic pains, tendency to occasional puffiness by superficial cedema, with inability long to maintain the erect posture, and still less to bear any considerable weight. The principal treatment will consist of kindness to old age; local support by bandaging or “cap;” and perhaps complete rest, with light counter-irritation, for a time, should the symptoms prove unusually urgent, and the inflammatory process threaten to supervene. Long confinement and severe local remedies are inexpedient; for it is not to be expected that the atrophy will be so arrested; and the general health would surely suffer.

Porcellanous Change, Eburnation.

This may follow on destructive disintegration of cartilage ; one mode of reparation being by the aid of dense osseous formation, assuming a vitreous polish, as formerly explained. But more frequently it follows on the foregoing affection—atrophy, constituting a part of the changes resulting from chronic rheumatic arthritis. The bone is exposed, by the gradual removal of the superimposed cartilage ; and then, the absorbent process usually ceasing, a restorative is begun. New cartilage cannot be produced, but a very efficient substitute may ; a texture not soft, elastic, and finely lubricated ; but dense, smooth, and of the finest polish. In some cases, the open texture of the exposed bone is retained ; as if this had merely become condensed and polished on its very surface, by dint of pressure and friction, while the open cancelli, possessing a honey-comb appearance, become occupied with tough, fibrous, or ligamentous texture, presenting at times a tufted or villous appearance ; but more frequently the existence of a new osseous product is plainly evinced, by closure of the cancelli ; the glistening surface in the macerated bone then presents a compact and unbroken aspect, and sometimes this new deposit of bone is of very considerable thickness. Very frequently the opposing porcellanous surfaces—as of the tibia and femur—fit into each other by grooves and ridges ; and thus, motion becomes not only crank but limited. The formation of new osseous matter exterior to the joint is also not uncommon ; another serious obstacle to function. In some instances, the porcellanous change is effected by direct calcification of the articular cartilage, in which change of structure has been obviously going on for some time.

This porcellanous material has little resemblance to true bone ; and by some it is spoken of as an unorganized amorphous secretion of phosphate of lime. But the new formation is found to contain a proportion of calcareous matters not much different from that of ordinary bone ; and more careful investigation has shewn it to be perfectly organized—the only difference being that the bony tissue has become at that part perfectly calcified, requiring maceration in a dilute mineral acid to enable its structural elements to be properly shewn.

The symptoms are similar to those of the most usual cause—chronic rheumatic arthritis.

Chronic Rheumatic Arthritis.

This composite disease, for an accurate knowledge of which we are indebted to Haygarth, Sir B. Brodie, Cruveilhier, R. W. Smith, Canton, and most of all to Dr. Adams of the Richmond Hospital, Dublin, may originate either from a local and accidental cause, such as a sprain or bruise, or may commence spontaneously. In the latter instance, both the luxurious class of the community, and the hard-worked labourer, especially the aged paupers of our workhouses, are liable to suffer. In such circumstances, pre-existent acute rheumatism, exposure to cold, and the existence of causes of general depression, have been blamed as its source. Thus commencing, attended by rheumatic symptoms throughout, tending to changes of a more decided and advanced kind in the osseous than in any other texture implicated during the progress of the disease, yielding to

treatment certainly adapted to influence the progress of disease of the osseous rather than of the synovial textures, we are inclined to conclude that the situation we have chosen for the consideration of this complex disease is the right one. In other words, it is essentially a disease of the articulating extremities of the bones entering into the composition of



Fig. 155.

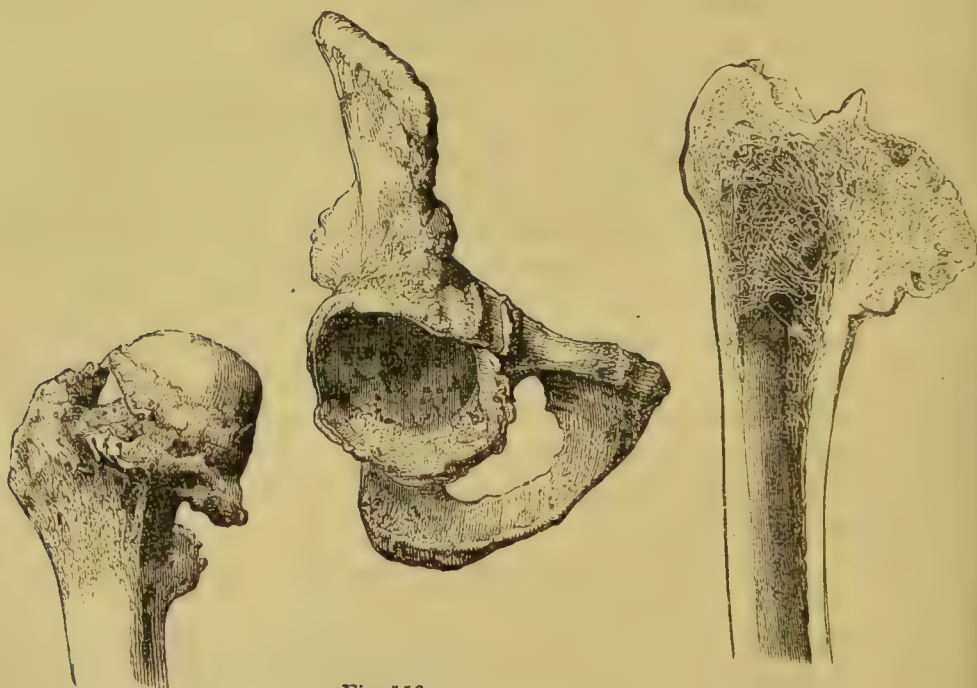


Fig 156.



Fig. 157.

the affected joints, and the implication of the cartilaginous, synovial, and fibrous structures, is sympathetic and secondary, corresponding to what we have called the second ring of the inflammatory process, and not the point of departure for this affection.

Fig. 155. Alterations in head and neck of femur, roughly shewn, in series.

Fig. 156. Head of femur and acetabulum much altered by chronic change; causing shortening of the limb, and stiffness of the joint.

Fig. 157. Femur bisected; head atrophied and altered; neck gone; the result of interstitial absorption. Shortening and lameness inevitably great.

The symptoms which characterize the commencement of this disease are more or less severe aching or gnawing pain, especially severe at night and in the morning, aggravated by motion—more especially after sitting or lying still for a time, and accompanied with tenderness on pressure, and more or less stiffness. Effusion also takes place into the joints, usually in very moderate quantity; sometimes, however, amounting to *hydrops articuli*. As the disease advances, the stiffness may, in some joints, amount to rigidity. Sometimes the relaxed ligamentous textures, and other changes in the joint, admit of subluxation, or even of complete displacement. Nodosities form round the articulation; but true bony ankylosis never takes place, and suppuration as a result is unknown. Sometimes the bursæ in the neighbourhood become distended with fluid.

The non-traumatic form is perhaps most frequent in women, and in them usually affects the joints of the hands. In men, again, it occurs more frequently in the hip-joints than elsewhere; but any, and every articulation may be affected, singly or in combination, in either sex. In examining a joint such as the hip, affected with this disease, the capsule of the articulation will be found always to have undergone considerable, sometimes very great thickening—in one case, mentioned by Dr. Adams to the extent of half an inch. Sometimes bony deposit in plates or nodules occurs in its textures. The synovial membrane is at the same time thickened and more vascular; especially its “tufts,” plicæ vasculosæ, synovial fringes, or haversian glands, as these structures have been variously denominated. If the affection is in its early stage, more or less fluid will be found within the cavity; and on opening the joint, the ligamentous and cartilaginous textures will be found greatly changed: for example, the round ligament of the hip gone; the tendon of the biceps in the shoulder-joint disappeared, or so altered as not to be recognizable; the cartilages of incrustation changed in structure or altogether removed; the cartilaginous rim of the acetabulum ossified; the interarticular cartilages of the knee, jaw, and sterno-clavicular joints, either gone or partially ossified, and continuous with the articulating surfaces. In the ginglymoid joints, the relaxation of the ligamentous textures, and the changes in the form of the articulating surfaces of the bones, sometimes admit of dislocation; and in the shoulder-joint either complete or partial displacement of the head of the humerus is very common. In some cases one or several loose or attached cartilaginous, or even osseous bodies, exist within the joints, developed obviously within the fimbriae, or excrescences into which the vascular fringes have gradually been transformed. These, when of considerable size and chiefly osseous, have been called *aditamentary* bones, and are not due to fracture of some portion of the articulating surface as was originally suggested by Ambrose Paré. The osseous textures forming the articulating surfaces are greatly changed. The place of the cartilage is occupied partly by dense fibro-cartilaginous tissue, and porcellanous change. Marginal deposits of bone, continuous as a ridge, or in tiers, and stalactitic processes, surround the articulating surfaces and neck of the bone. The articulating surfaces appear flattened out, the articulating cavities flattened and rendered shallow, while the texture of the bone in the neighbourhood is hardened and condensed. Besides, in the case of such a bone as the femur, its neck becomes shortened; the

head approaching the trochanter, till at length it seems to be set on there, without any intervening neck at all. At the same time, the angle of insertion is changed ; the natural obliquity upwards becoming altered towards the rectangular position ; and, ultimately, the head of the bone may even descend to form an angle of a kind precisely opposite to that which is normal. The degree of shortening may vary, from half an inch to two or even three inches ; and the lameness is in proportion (Fig. 155).

Practically, the occurrence of such change becomes of the greatest importance ; for, as we have said, this important affection of the hip is apt to occur in consequence of external violence. Suppose, for example, that an elderly man sustains contusion of the hip by a fall, and is taken up lame. Fracture of the neck of the femur is naturally suspected. But, on a very careful examination, the usual signs of this form of injury are found wholly wanting ; and the surgeon is satisfied that the case is one of mere bruise. Treatment is conducted accordingly. Unaware of the probability of such change in the relation of the head and neck of the bone to the shaft, as has been now described, being likely to occur, the surgeon has not protected himself by his prognosis ; and never thought of forewarning the patient and his friends, that by the occurrence of such change the more prominent symptoms of fracture may by and by be closely simulated. After three or four weeks of confinement, on account of the results of the bruise—

for, in the aged, such time is not unfrequently required for disappearance of the pain and lameness—the patient, getting up, attempts to walk ; and then, for the first time, a shortening of the limb is noticed, which may amount to half an inch, or more. The surgeon is surprised, and the patient is mortified, perhaps indignant ; being naturally led to suppose that his case has been mistaken, and consequently mismanaged ; that what was called and treated as a bruise, had been after all a fracture. Whereas, had not only the possibility but the probability of such change been known and remembered, all would have been rightly understood



Fig. 158.



Fig. 159.

and patiently submitted to. The feelings of the patient and his friends, and the reputation of the surgeon would have been alike saved. Nay,

Fig. 158. Comparative view of this cause of shortening of the hip.

Fig. 159. The same isolated, and bisected.

more, let it be recollected that the change produced by this disease has sometimes been so great as to have led even experienced pathologists to believe, when the post-mortem result was before them, that a fracture had really taken place (Cruveilhier's *Anat. Patholog.*, liv. ix., p. 10).

Treatment in the early stage of this complex affection should be both general and local—repose, leeching, cupping, blistering, the use of the hot douche, and warm salt-water bathing, constituting the essentials of the latter. The constitutional treatment should consist in the careful regulation of diet, a moderate use of animal food, avoidance of all raw vegetables; while acid fruits, sugar, fermented and spirituous liquors, should be strictly forbidden. Mercurials, colchicum, potash, magnesia, iodine, and cod-liver oil, will be found very serviceable—*pro ré natâ*. When there is much pain opiates must be given, and the button cautery will be found an important means for effecting local counter-irritation. The actual cautery is not nearly so useful as in the acute affections of the articulating ends of bones. In the later stage of the affection, moderate exercise of the joint will prove very beneficial, and the local use of cod-liver oil in some cases apparently produces a salutary effect. For patients whose circumstances admit of it, a residence in a warm climate, or a resort to the baths of Bath, Buxton, Aix-la-Chapelle, Wildbad, or Wiesbaden, should be recommended. With some, regular shampooing, the vapour-bath, and the use of sulphur and guaiacum internally, have been found signally serviceable.

Destruction of Bone in Joints.

1. *Articular Ulcer*.—This is connected with the destruction of cartilage just described. The disorganization may extend from the synovial membrane to the cartilage, and thence to the subjacent bone. Or the bone may be first involved, and the cartilage suffer secondarily; partly by death and exfoliation, and partly by corpuscular formation and consequent disintegration. The loss of substance may be more or less extensive; but is seldom great. The symptoms are similar to those of destruction of cartilage in its advanced stage. So is the treatment; consisting mainly of rest and counter-irritation. According to the form, extent, and progress of the disease, the cure will be by simple healing, with or without porcellaneous formation; or by ankylosis.

2. *Articular Caries*.—This is the more intractable and extensive destruction of bone; which may be either simple, and then generally due to the irritation kept up by the presence of two ulcerated spicular osseous surfaces against each other; or it may be preceded and accompanied by scrofulous change. It may originate in disorganization of cartilage; the exposed bone perhaps being at first simply ulcerated, and afterwards degenerating into the truly carious condition. Or the original disease may be gelatinous degeneration of the synovial membrane; the articulating ends of the bones becoming carious on establishment of the suppurative stage. Or the carious state may originate in the cancellated texture; cartilage and synovial membrane becoming secondarily involved. And then there is, usually, the precedence and co-existence of a scrofulous ostitic change; the case being

one of an obviously scrofulous kind. According to the mode of origin, the symptoms vary ; assuming the type of one or other of the affections which have been described in the preceding pages. In fact, this disease may be practically regarded as the advanced stage of the three most formidable affections to which joints are liable ; degeneration of the synovial membrane, destruction of cartilage, and suppurative disintegration of the articulating ends of the bones—with or without the scrofulous cachexy.

In the treatment, three results may be looked to ; as in ordinary caries. 1. On establishment of the open state of the joint, disintegration advances rapidly ; thereby the carious surface may be wholly destroyed, a tolerably sound part remaining ; and on this basis a reparative structure may be reared, sufficient for completion of the cure by ankylosis. 2. Or, the foregoing result being plainly hopeless—yet the disease not being very extensive, the system not greatly depressed by the hectic cause, and the scrofulous cachexy either absent or but slightly and chronically developed—the ordinary treatment for caries may be put in force. The diseased parts may be exposed by incision, and removed ; the cure being subsequently either by ankylosis, or by the establishment of false joint, according to



Fig. 160.

circumstances. Such an operation is termed Resection of a joint. 3. Or, neither of the preceding events being practicable, and the frame yielding visibly under hectic, amputation is the only remaining remedy ; and, harsh though it be, it is our duty to avail ourselves of it, unless when contra-indicated by the circumstances formerly detailed.

Ankylosis.

Stiffness of a joint, as can be readily understood from what has been stated, may depend on various conditions of the articulation, and of the parts exterior. Accordingly, ankylosis is said to be of different kinds.

1. *Osseous or Complete.*—This is the result of ulceration of the opposed articulating surfaces ; the osseous texture having subsequently become engaged in a successful effort of repair, and the opposing bones become firmly united by incorporation. Or the ankylosis may be in a great measure unconnected with change in the interior ; depending mainly on exuberant ossification on the external aspect. The joint becomes immovably locked in the tight embrace of an outer case of bone, continuous and incorporated with the original tissue ; the result of a chronic inflammatory process, of a formative type, and probably connected with

Fig. 160. Articular caries, affecting the hip-joint.

rheumatism. Or both forms may be combined ; the ankylosis being general, and at every point complete ; and almost all traces of previous articulation having become effaced.

2. *Fibrous*.—The destroyed cartilage is replaced by fibrous tissue ; and the opposing surfaces become thus united, giving rise to almost complete loss of motion. Frequently this form of ankylosis passes into the preceding.

3. *Ligamentous*.—The articular surfaces remain unincorporated at every part ; but are kept in close union, and more or less immovable, by alteration in the ligamentous apparatus exterior, which has become condensed, rigid, and non-elastic.

4. *Spurious*.—In this form, there is neither amalgamation of the bones, nor much, if any, structural change of the proper ligaments of the joint. But plastic change has occurred extensively, exterior to both ; the flexor muscles and tendons have become contracted and rigid ; and, from



Fig. 161.

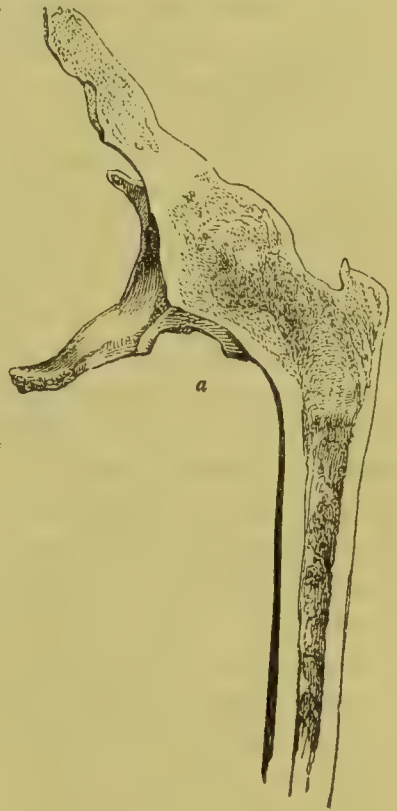


Fig. 162.

this cause, motion is more or less impaired. This state may or may not be conjoined with synovial disease within the articulation ; frequently it is. Lastly from hysteria, or a desire to simulate disease, the joint is kept rigidly fixed from involuntary or voluntary contraction of the muscles by which it is surrounded.

Treatment.—In every case of ankylosis the diagnosis of its true nature will be much facilitated by putting the patient under the influence of chloroform. Then many a joint, which previously had been firmly fixed, is violently moved in every direction, as the patient struggles during the administration of the drug ; or it relaxes of its own accord, as the patient falls over asleep ; while others, in which motion was apparently very limited or completely checked, will be found much more mobile than they previously seemed.

Fig. 161. Cure of morbus coxarius by osseous ankylosis.

Fig. 162. The same, bisected, to shew continuity of texture.

All cases where ankylosis really exists should be warily interfered with. It is a cure certainly imperfect ; yet both a saving of the part, and a cessation of morbid progress ; and may be regarded as a compromise between health and disease—the rash infringement of which is apt to be visited by untoward consequences. The true form is plainly not to be broken up, either by gentle or by violent means. The latter have been made trial of, with a result truly deplorable. The only means of treatment available is either excision of the articulating ends of the bone, or a resort, as formerly noticed, to section exterior to the obliterated joint, and formation of a false joint there ; an operation which has been successfully applied to the hip and knee-joints, but in regard to the expediency of which we desiderate a larger experience.*

Fortunately, the true form of ankylosis is that which most rarely occurs. A joint may seem to be rigidly immovable by ossification, yet may be altogether free from that form of structural change, and quite capable of a resumed though diminished function ; being, in truth, an example of one of the other forms of the affection. All of these admit of cure. In many cases, function may be wholly restored ; in others, the restoration is never complete. In no case should it be attempted, till all active disease has wholly subsided within the joint ; and even then, the process of cure should be warily and gradually conducted, lest re-accession of disease ensue. The means of restoration are :—I. Passive motion, frequently employed, with all gentleness, and always regulated by the sensations of the patient ; friction, with embrocations of a stimulant nature, especially over the extensor muscles ; local steam bath ; shampooing ; and, if need be, division, by subcutaneous section, of the rigid flexor tendons. Splints, bandaging, and other mechanical means, are also often of service, in restoring normal position of the joint ; not suddenly, but slowly, and with much caution. And this aid is especially necessary in those cases, by no means few, in which there is not merely flexion of the joint to be undone, but rotation also. Thus, in the knee, as already stated, flexion is seldom great, without rotation outwards of the head of the tibia ; and unless this be rectified—as can only be done by mechanical means—the cure is obviously incomplete. When tenotomy has been employed, the restorative measures by friction, motion, and machinery, are prudently delayed until the punctures have fairly healed, otherwise suppuration might be readily induced. II. The patient having been placed fully under the influence of chloroform, and tenotomy premised if need be, the ankylosis is broken up by forcible flexion and extension of the limb, the after treatment of the articulation being that just detailed.

True ankylosis, in which ordinary remedial means are hopeless, may be known—when, in addition to absolute immobility of the joint, even under considerable force, the patient being chloroformed, the flexor

* The operation alluded to has been performed three times upon the hip, and nine times upon the knee, in America. In one case a fatal result occurred. Obviously the proceeding is by no means devoid of danger ; and the circumstances of a case would require to be well considered, as well as urgent, ere such heroic practice be determined on. For details, see a copious note by the learned editor, Dr. Sargent, in the American edition of this work, Philadelphia, 1852.

muscles and tendons are hard, rigid, and at no time, and under no circumstance, shew the slightest variation of condition.

The propriety of attention to position in the joint may be here again urged, in those cases in which the occurrence of complete and irremediable ankylosis is expected, in order that the rigid member may possess its maximum of usefulness ; while the satisfactory results attending upon excision of the elbow should determine our choice of resorting at an early period to this operation, rather than to continue treatment which can only terminate in ankylosis as its best result.

Resection or Excision of Joints.

Articular caries is the disease which demands this operation. The joints most suited to its performance are the elbow and shoulder. In some forms of external injury, as will afterwards be seen, removal of the head of the femur is far from being an unwarrantable proceeding ; and there are also some rare cases of morbus coxarius, in which recourse to resection is by no means unreasonable. The knee, too, has been resected for disease, with varying success. But upon the whole these last named joints, as well as those of the wrist and ankle, must hold a subordinate place as to suitableness for the operation.

Resection of joints was first proposed and practised, in the end of last century, by Mr. White of Manchester, Mr. Park of Liverpool, and M. Moreau of Paris. For a time it fell into desuetude. But in the beginning of the present century it was revived by various surgeons ; among whom Roux, Hey, and Crampton, may be mentioned. And from Mr. Syme it has received such especial impetus, as to place it secure among the regular operations of surgery ; and those of the better class too—Conservative.

By free incision, the joint is reached ; and by cautious dissection, the diseased parts are exposed to their full extent. Then, by the saw, cutting pliers, or both, not only the carious surface is removed, but also the soft, spongy, impotent, and softened texture beyond. The cutting pliers are very useful in opening up the joint ; but for the final section of the bone the saw is always to be preferred, leaving no bruise behind. During the dissection for full exposure of the diseased parts, the knife's edge is carried in close proximity to the bone ; so as to avoid unnecessary injury to the soft parts, especially the arterial and nervous trunks.

The soft parts may be very much altered in structure ; dense, pale, and swollen ; and the bone external to the articulation may be spicular and stalactitic ; yet experience tells us that it is unnecessary to remove any portion of them. On re-adjustment of the wound, fresh and more vigorous suppuration is established ; and the altered tissues change, ultimately coming to form healthy granulations, and otherwise contributing to completion of the cure.

Adhesion of the wound is not to be expected ; and treatment is directed accordingly, so as to secure a free drain for blood, serum, and the results of suppuration afterwards. The greater part of the surface of the incision may, however, adhere at once ; and in some joints, accord-

ing to the method practised for their excision, the success of the operation is greatly dependent upon the occurrence of this result. When suppuration becomes fairly established, and threatens to prove excessive, means may be taken for its abatement. Then, the reparative stage having fairly commenced, by occasional passive motion the construction of a false joint is favoured : experience having shewn that motion, duly employed, is not only capable of inducing the formation of a very useful hinge—at first flexible and weak, but gradually becoming firmer and of greater power—but also, if a sufficiency of diseased bone has been removed, and the patient is healthy, that there is no risk of re-inducing disease, by inflammatory accession and its results. In the case of the knee-joint, however, when ankylosis is desired, as obviously most consistent with usefulness of the limb, from the very first our treatment by means of appropriate splints and apparatus is adapted to secure as complete immobility as possible.

Mr. Syme, to whom the profession is much indebted for his successful exertions in this department of operative surgery, thus describes the condition of the limb, when a fortunate issue has ensued :—"It has been proved by numerous facts, that while the joints beyond the disease remain as useful as ever, the one which has undergone the operation regains such a degree of mobility and subjection to the action of its muscles, as sometimes to render it hardly distinguishable from a sound one, and in general prevents it from at all impeding the use of the arm by its stiffness. There is no new joint, strictly speaking, formed ; but a strong fibrous substance unites the extremities of the bones, and by its flexibility allows them to move within proper bounds ; while the muscles cut across in the operation obtain new attachments, so as to perform their usual office."

In determining on the operation of resection, it should invariably be well considered whether there be a fair prospect of an issue in all respects prosperous ; and but little chance of amputation being ultimately demanded, by re-induction of the disease, probably of an aggravated and acute form. Otherwise, it were better at once to have recourse to the latter operation. A worn system, originally by no means strong, may have power enough to bear up under either resection or amputation ; and yet may be certain to give way under a combination of the two. 1. The patient's age is an important point. For resection, he should be neither very young nor very old. If very young, the section of the bone made through the end of the shaft effects removal of the epiphysis, thus precluding to a great extent the further growth of the limb, and determining, especially in the lower extremity, its ultimate uselessness. Besides, scrofula is likely to be much concerned in the disease—not of a quiet but of an acute kind, and as it were restlessly active. In the old, there may be want of restorative energy in the wound. The most favourable cases are those which occur during adolescence when the elasticity and vigour of youth are on our side ; and when consequently, special success may be expected. 2. The system should not be much exhausted ; otherwise re-induction of disease is favoured by want of power both locally and generally. Besides, it may happen that suppuration in the wound proves excessive, unaccompanied by efficient effort at repair ; and, in consequence, removal

the hectic cause by amputation may be demanded. The certainty of suppuration, profuse and perhaps protracted, and the chance of amputation following thereon, should never be omitted in our prognostic calculations. 3. By careful examination with the probe, and by manipulation, we should be satisfied that the disease is of no great extent beyond the mere articular extremities. For it is plain that the removal of several inches of each bone—and unless all the diseased part be thoroughly taken away, the operation had better not be attempted—cannot be expected to be followed by even an approach to cure in any way satisfactory; and ought to be superseded by the then not more harsh procedure of amputation. Regarding extensive involvement of the soft parts, we need be less anxious; they being capable of recovery under apparently very adverse circumstances, as already stated. 4. The operation is not to be undertaken during inflammatory activity, either of the soft parts or of the hard. If such exist, it must first be subdued by the ordinary means. 5. The more intense the development of the scrofulous diathesis, the more unfavourable the case for resection; and *vice versâ*. 6. The successful results of excision, it must be borne in mind, and the small fatality which attends upon it, will justify a resort to it at a much earlier period of the disease, especially in the elbow-joint, than would have rendered amputation necessary in former times.

Loose Bodies in Joints.

Loose substances, usually of an irregularly oval form, are sometimes found floating within joints; and the one most liable to this affection is the knee. They are commonly termed cartilages; but they vary in structure and consistence. Sometimes they are of almost calcareous or osseous density; sometimes they are soft and fatty; most frequently they consist of fibrous tissue, containing more or less of cartilage—shewing in section the appearance which is usually termed fibro-cartilaginous. They vary in size from a pea to a prune; the average dimensions are those of a flattened middle-sized bean. The surface is generally smooth; but sometimes broken by slight nodosities. Most frequently they occur singly; and seldom more than two or three are found in any one joint. Sometimes they are not, strictly speaking, loose, but attached by a delicate, sometimes thread-like, neck to the capsule of the joint.

These bodies have been supposed to be formed in various ways. 1. By external growth. A plastic formation takes place externally to the synovial membrane; and as it enlarges, that membrane is pushed before, forming a close envelope. The little mass projects into the cavity of the joint, and is not unlikely to assume a pedunculated character. On



Fig. 163.

Fig. 163. Trochlea of humerus; shewing formation and connexion of loose cartilaginous bodies.

a sudden movement, the peduncle may be severed ; and the extraneous substance is thrown loose into the joint. 2. More probably, by internal formation, in the substance of the synovial membrane. A change takes place in the nutrition of the *plicæ vasculosæ*, as in the "fimbriated" condition formerly described ; the formation not occurring in the whole range of the *plicæ vasculosæ*, but in individual fimbriæ. And it is not difficult to imagine how one such formation, at first attached, may become separate, and float loose within the cavity. 3. By limited hypertrophy of the original cartilage. Joints—especially those of the elbow and knee—are not unfrequently found in museums, with irregular enlargement of their cartilage, and also of the subjacent bone, at the outer rim of the cartilaginous surface. Part of these excrescences may point towards the joint, shewing more or less of the pedunculated form ; and portions may be found within the joint, some quite loose, and others yet adherent. Such preparations sufficiently indicate the abnormal process which may prove one of the modes of origin to loose articular bodies. It should also be observed, however, that such enlargement is not mere hypertrophy of the original cartilage. The texture is changed, becoming more dense and fibrous ; and it is a portion of this altered tissue which is projected and detached. A strong argument against fracture of either normal or altered cartilage being the source of such bodies, is that they present an uniform, oval, smooth, unbroken surface ; that they occur frequently where no injury of the joint has occurred ; and that they are met with in the same articulation, at times, both in the attached and non-attached form, obviously both due to the same source—viz., the synovial fimbriæ.

However occasioned, the symptoms are, in general, sufficiently distinct. At times there is no uneasiness ; the foreign body remaining in a part of the joint removed from the play of the bones. Suddenly, however, it may become dislodged from this retreat ; and, coming between the ends of the bones, on an instant the most excruciating pain is endured ; the limb is rendered rigid, and motion arrested, as if by a spell ; and the distressing symptoms are not relieved, until, by gentle flexion and manipulation, the intruding substance has been again placed in an unoffending position. Such occurrences, by frequent repetition, are themselves a source of much inconvenience and discomfort ; and, besides, they are not unlikely to prove the means of lighting up an inflammatory process, whereby the most serious consequences may ensue. Accordingly, in such cases more or less dropsical effusion will be found to coexist with the loose body in the joint,—sometimes indeed so considerable as, during its existence, to conceal the presence of the cartilaginous nodule. It becomes an object of some importance, therefore, either to palliate the evils ; or, by removal of their cause, to dispel them altogether.

Treatment.—When inconvenience is not much complained of—only occasional, then not very severe, and remedied with tolerable facility—treatment should be but palliative. For, under such circumstances, operation is scarcely warranted ; and puncture of such an important articulation as the knee, the most common site of these bodies, is never wholly free from risk, however skilfully and carefully conducted. Furthermore, experience has fully proved that any operation, needlessly

though well performed, has an especial tendency towards an unfavourable issue. An elastic bandage, or tightly fitting knee-cap, is applied, and constantly worn; with the view of restricting the body within its own domain—where it proves inoffensive. Should it, at any time, nevertheless escape and become jammed between the head of the tibia and condyles of the femur, it is to be instantly replaced, and the apparatus assumed as before; and recumbency is advisable, for a few hours afterwards, in order that local excitement may wholly pass away.

Not unfrequently, however, palliation fails. The patient's life is rendered miserable, and himself unfit for active occupation; also, organic disease may be threatened, by the oft-repeated local excitement accompanied with serous effusion. In such cases, the patient may urgently demand removal of the offending substance by operation; and, fortunately his request may now-a-days be agreed to, with a fair prospect of success. The subcutaneous and valvular mode of puncture is adopted; the adaptation of which method of treatment, to such cases, was resorted to, independently of each other, in our own country and in France, by Messrs. Syme and Goyrand.

In the first place, the patient is to be prepared for the operation. For a day or two, the limb is to be disused; so that previous excitement may have thoroughly subsided, and all fluid in the joint become absorbed. Low diet is enjoined, the primæ viæ are gently yet efficiently cleared, and general secretion is seen to be in a satisfactory state; so that there may be no predisposition to inflammatory excess, and no necessity for disturbing the patient for some days after the operation. Then the foreign body, having been made superficial, is pushed to the extreme verge of the synovial pouch—either on the inside or on the outside of the patella, as may be most convenient; and there it is retained fixedly, by the fingers of an assistant. A tenotomy knife, or thin and narrow bistoury, of fine edge, is passed in an oblique direction beneath the skin; and an incision is first made parallel to the skin and capsule of the joint, so as to form a cavity for the cartilage to occupy when excluded from the joint. This should be a little larger than the outline of the cartilage. Another incision is then made through the tense synovial membrane; pressing the knife's edge very firmly on the cartilage, so as to make as sure as possible of the wound being in all its extent complete—no fibre left undivided. The instrument is then withdrawn slowly and cautiously, the finger gently yet firmly following and consolidating its track. A few drops of blood escape, but not a particle of synovia; and no air has obtained admission, even to the areolar tissue. The integumental wound is immediately and carefully occluded, by plaster or collodion.

The foreign body is then pressed through the aperture in the synovial capsule; which aperture, as has just been stated, is made sufficiently free to admit of this being accomplished without force or difficulty. At least such is the indication. But, truth to tell, this is the difficulty of the case. With all care the wound is sometimes imperfect or insufficient, and through it the cartilage will not be coaxed readily, if at all. When once it is lodged, by gentle pressure of the fingers, in the areolar tissue, exterior to the capsule, where the pouch has been prepared to receive it, here it is permitted to remain. Not permanently, however, as has been

proposed. Otherwise, acting as a foreign body, an inflammatory process may be excited, suppuration may occur, and extension to the synovial membrane take place; the very result to the avoidance of which all our pains had been directed. For two or three days, therefore, it is suffered to remain in its new locality, undisturbed; the most careful prophylactic treatment being meanwhile employed, both generally and locally, so as to avert undue excitement. By that time, the synovial wound will have closed by adhesion; and both tracks—that of puncture, as well as that of extrusion—will have been consolidated. Then, the body having been fixed as before, a direct incision is made upon it, through the skin; not more free than is sufficient for its ready removal. After it has been lifted out, the superficial and slight wound is accurately brought together; and, in all probability, it unites by adhesion.

For some time after the operation, the limb is kept rigidly immovable, yet comfortably placed; splints being employed, if necessary, in addition to well-adjusted pillows; and the most strict antiphlogistic regimen is enjoined. Cold is applied to the part—by evaporating lotions, or by simple water-dressing; and all bandaging, compresses, pledgets, and multiplicity of plasters are to be avoided, as being likely to engender what we most seek to avert.

The operation, as we would advise it, is thus seen to consist of distinct parts. 1. The prophylactic preparation; occupying not less than several days. 2. The oblique valvular puncture and preparation of a cul de sac; carefully avoiding the entrance of atmospheric air, even into the superficial areolar tissue. 3. Extrusion of the loose body into the tissues external to the joint; and lodgment of it, subcutaneously, as far as possible from the synovial wound. The second and third parts of the procedure are accomplished at once, in immediate succession; and then two or three days, not more, are allowed to elapse with a view to consolidation of the wounds. 4. By a direct incision, the offending substance is finally removed from its temporary abode.

By another mode, a cure has been attempted. Where a patient averse to cutting instruments has been much annoyed by the disorder in question—and where other circumstances have existed, rendering the propriety of even subcutaneous incision questionable—an attempt has been made to secure the foreign body in a safe part of the joint, by transfixion. The same preparatory treatment having been employed, and the cartilage having been similarly held, in a favourable locality, a hare-lip pin, or finer needle, is passed through the capsule of the joint, so as to entangle the surface of the body in its hold; or, should the consistence of this prove not great, it may even be completely transfixed. A few turns of a thread then suffices to keep the needle in its place. After some days, it is gently withdrawn; and rest, with antiphlogistic regimen, is strictly maintained. Sufficient plastic product is expected along the track of the needle, that thereby the previously movable substance may be incorporated with the parts, and become permanently resident where its presence can produce little or no inconvenience.

My own experience of this mode of treatment, however, is unfavourable. The difficulties are, 1, in making sure of the transfixion of the cartilage, which, in virtue of its lubricity, is very apt to elude the needle

point : 2, the uncertainty of obtaining enough plastic change, to ensure consolidation at the transfixed part : 3, an equal uncertainty in avoiding inflammatory excess, whereby formidable synovitis may be induced. I have abandoned the practice.

Mr. Syme has recommended the fixing of the foreign body by means of a simple subcutaneous incision of the capsule over it ; retaining the cartilage, by means of pads of lint and a bandage, till united, in the lips of the incision ; and then within a few days applying a blister to the skin at that part, to excite further plastic change, followed by absorptive removal of the body.

As already stated, no operation is expedient unless in troublesome cases, and with much precaution. For experience has shewn that even the modern operative procedure is not free from risk.

The Inflammatory Process in the Exterior of Joints.

This may be of the simple and ordinary kind ; and then prone to suppuration. Or it may be of an obviously rheumatic character ; tending rather to chronic change of structure.

1. *Simple*.—The inflammatory process, occurring in the parts immediately exterior to a joint, unconnected with any peculiar condition of system, is usually acute ; and tends towards the suppurative crisis. It may be the consequence of external injury ; or it may be but a part of some more extensive disorder—as erysipelas. Or the affection may be idiopathic and chronic in its nature ; causing at first plastic formation with hard swelling and stiffness of the joint, dull and indolent ; and, after months passed in this type, then advancing to suppuration. However occasioned, suppuration follows the usual course ; and the matter seeks the surface. If opposed in that direction—as it is certain to be, if originating among, and not exterior to the fibrous tissues—it cannot but extend also both laterally and in depth ; so obviously and imminently endangering the articulation. If purulent irruption take place there, it will be hard to prevent immediate invasion of such inflammatory change as shall result in the destruction of all the component textures, as well as in the establishment of the most violent



Fig. 164.

and alarming constitutional disturbance.

Treatment, therefore, must be early, and actively antiphlogistic ; in order to arrest the inflammatory process, if possible, ere the suppurative crisis shall have been attained. When this has occurred, an incision can scarcely be made too early ; free and dependent.

2. *Rheumatic*.—When acute, this is usually merged in a deeper and

Fig. 164. Chronic ostitis ; serious structural change on the exterior of the affected bones. The result of chronic rheumatism.

more important affection. Originating exteriorly to the joint, this sooner or later is involved—usually at a very early period ; and the case may then be considered as one truly of rheumatic synovitis. But the chronic form very often is not only originally, but permanently, wholly exterior to the articulation. Or, if the latter do sympathize, it is only in a very minor degree ; not greater sympathy than the exterior often shews in the less serious inflammatory affections of the joint. The inflammatory process is ordinarily of a low grade, as well as chronic in its nature ; situated in the periosteal investment of the articulating extremities of the bones, in the fibrous tissues exterior to the joint, or in both. The progress, results, and treatment of this affection have already been considered.

Tophi.—These are concretions connected with the extreme joints, more particularly of the fingers ; sometimes within the articulation, more frequently exterior to it—at least in the first instance ; and are composed of the urate of soda. They are undoubtedly connected with, and probably owe their origin to the gouty diathesis. They may remain in an inactive state, either stationary or gradually enlarging, for a long period. Or imperfect suppuration may occur on the surface ; opening the skin, and disclosing the concrete matter slowly disintegrating, and crumbling tardily away with thin puriform discharge. And this may be accompanied with some pain, and with redness and swelling of the surrounding integument. Or chronic and imperfect suppuration and softening may pervade the whole mass, instead of being limited to the surface. This however is a comparatively harmless event ; seeing that the proper texture of the joint has been previously annihilated, by gradual structural change—antecedent to the peculiar deposit, or at least co-existent with it. What was the joint may be opened into ; but the circumstance will not be marked by any of these serious consequences which would be certain to accrue, did any part of the synovial apparatus remain.

Such concretions, when fairly formed, are plainly but little amenable to local treatment. The great object is to prevent their formation ; by constitutional management directed against their cause.

Neuralgia of Joints.

Examples of local irritation in joints are not unfrequent ; in which the inflammatory process is almost wholly in abeyance. The prominent characteristic is pain ; unaccompanied by swelling, or other indication of structural change. The affection may be primary ; constituting a disease *per se*. Or it may be secondary ; merely a symptom of an earlier and more grave disorder. In the knee, for example, we may have nervous pain, either as a symptom of morbus coxarius, or a truly neuralgic affection of that part independent of disease elsewhere. Although, indeed, the last observation must be made with some reservation ; inasmuch as there are found but few cases of neuralgia, in that or any other joint, which are not more or less connected with a perverted state as to structure, function, or both, in some of the internal organs.

Neuralgic affection of the joints is characterised by a class of symp-

toms sufficiently distinct ; a circumstance of much importance, seeing that the appropriate treatment is very different from that which is demanded for structural change. Pain has the ordinary character of the nervous ; remittent, intermittent, not slowly and steadily increasing, not constant, not increased by pressure, and not limited to one part, but diffused over the whole of a wide extent of surface. The patient's mind may be diverted from the uneasiness, by conversation, or otherwise engaging the attention ; and while the mind is so occupied the pain is really absent. There is no swelling. At least, if there be, it is but trivial in all respects ; a mere puffiness, by cedema of the surface ; not at all resembling what follows inflammatory change in any of the textures of the joint. Motion is well borne—especially when unobserved ; and so is manipulation, even rude ; the uneasy sensations are not increased by either. The joint itself may be jarred, pressed, jerked, with impunity ; whereas, much complaint may follow pinching of the superimposed integument ; that texture, sometimes, seeming to be of greatly increased sensibility. There is no fixed flexion of the joint, as in serious structural change ; on the contrary, the limb may frequently be found extended. The spasms, too, are wanting, which so commonly attend and invariably aggravate acute inflammatory disease. The patient is obviously out of health ; and labours under irritation, general as well as local. But the system is uninvolved in either inflammatory or hectic fever.

This affection occurs more frequently in females than in males. And usually, the symptoms will be found at least connected with, if not caused by, disorder of an internal organ. In hysterical women joint-affections are sometimes altogether fictitious ; imagined or pretended. In children, some affections of the joints, apparently neuralgic, would seem to depend on the irritation of dentition.

Treatment is mainly directed towards the general system ; restoring normal functions to the uterus, stomach, and intestines, as the circumstances of the case may require. Local applications need be but simple. The serious treatment for structural change would be not only unnecessary, but certain to prove injurious. Something much lighter is required ; such as the application of a belladonna plaster, or ointment, the use of dry cupping, Faradization, or the endermic use of nitrate of silver so as merely to blacken the surface. This is not only really efficient towards mitigation of the neuralgia ; but also, having an imposing character in the eyes of the patient, is useful by satisfying the mental anxiety, which always attends, and sometimes is not the least prominent of the symptoms. Medicated friction, or fomentation, may also prove of service, in a similar manner. But every stimulus, at all powerful, should be either abstained from or most cautiously used ; inasmuch as the morbid nervous condition of the part may here, as elsewhere, prove but a stepping-stone towards inflammatory accession, entailing serious structural change.

The vital importance of a careful diagnosis need not be insisted on : lest, on the one hand, we treat with unwarrantable severity a comparatively trifling disorder ; and, on the other hand, lest we commit the greater error of supposing a really formidable change of structure in bone, cartilage, or synovial membrane, to be but a nervous affection, and do

not discover our mistake until loss of texture and function has become not only great but wholly irremediable.

Wounds of Joints.

Wounds, penetrating into the more important joints, are invariably to be regarded as among the gravest of injuries; and the danger is by suppurative synovitis. To the prevention or mitigation of this, treatment is be directed.

The signs of the accident are not indistinct. The nature of the weapon; the manner and degree of force with which it was applied; the extent, position, and form of the wound; the trickling of synovia, in the form of a viscid fluid, along with the ordinary serous discharge which the wound affords; the presence of a shock to the general nervous system, more or less intense—these, in the great majority of cases, are sufficiently plain indications of the joint having been opened. It is wholly unnecessary to use either the probe or finger, in exploration. Meddlesome surgery is never good; and in no case is it more decidedly bad than here. Many a joint may, under suitable treatment, resist the original injury successfully; but few are able to escape with impunity, from wound followed by rude, unskilful, unnecessary exploration.

When the lesion is of the lacerated or bruised kind, synovitis is inevitable. The track of the wound can heal only by granulation, which is invariably preceded by suppuration; and such affection of one part of the synovial membrane may scarcely be restrained from overspreading the whole. All that is in our power, under such circumstances, therefore, is to mitigate what we cannot avert.

When the wound is simple and incised, however, the object of our treatment is altogether prophylactic. By absolute rest, rigid antiphlogistic regimen, and the continued application of cold, during the period of incubation; by loss of blood, general and local, timeous and plentiful, so soon as inflammatory excess threatens to supervene; by calomel and opium, antimony, or other selection from the more powerful antiphlogistic remedies—we avert the suppurative crisis from both the interior of the joint and the wound's track; so obtaining for the latter union by adhesion. In favour of this result, disuse of suture is usually advisable; approximation being intrusted to plaster and position. But the metallic sutures may be used cautiously, if a stitch or two would favour more accurate approximation. Over the wound a pledget of lint should be laid, and retained by means of strips of plaster or a bandage; as by that mode of dressing another important indication may be fulfilled—exclusion of atmospheric influence.

When suppuration of the synovial membrane has occurred—as will sometimes be the case, notwithstanding our best care—more or less structural change takes place in that texture. It becomes thickened, infiltrated, and coated by plastic formation; at some parts, it may be broken by ulceration. Ruin of cartilage and bone is not unlikely to follow. Such cases are to be treated on the principles already inculcated for similar disease of a non-traumatic origin. The symptoms are certain to prove most urgent. The inflammatory fever will be of the gravest kind; and,

in addition to its ordinary signs, great irritability of the stomach is often both prominent and distressing. The swelling, pain, and discharge, will be proportionally great. Yet something like resolution may be effected ; all may become quiet, and the joint may recover not only its form, but almost its pristine motion. Or it stiffens, by ankylosis ; perhaps irremediably ; change of structure having gone so far as to leave no hope of cure, unless by copious new formation from the exposed bone. Or hectic becomes paramount, ere yet destruction of texture has ceased in the joint ; and then, to save life, we must sacrifice the limb.

AFFECTIONS OF BURSÆ.

Bursæ are lined by a delicate membrane ; closely resembling, both in health and in disease, the synovial investiture of joints. The majority are of original and normal formation, usually lying between the skin and some bony prominence ; a few are adventitious, the result of unwonted pressure, much or habitually applied. Some are closely connected with the more important joints, being in truth accessory to these ; others have no such relation, and are altogether insulated. The affections of the latter are comparatively trivial, as regards the ultimate result. Acute inflammatory affection of the former, on the contrary, is always to be regarded with suspicion, and treated with much anxiety and care.

As samples of subcutaneous bursæ, may be mentioned those which enlarge over the knee, in housemaids and shopkeepers ; over the insertion of the tendon of the patella, in carpenters ; on the elbow, in miners ; on the backs of porters and foot-soldiers ; on the acromion of those who sustain weight there ; on the chin or sternum, in joiners who rest their centre-bits on these parts ; on the salient points of club-feet ; on the hump of hunchbacks ; and on the outer malleoli of tailors.

Bursitis.

This may be either acute or chronic. The *Acute* form is usually the result of external violence, of exposure to cold, or of both these causes. The symptoms and results resemble those of synovitis. There is enlargement of the bursal cavity, by distension ; the secreted fluid being at first serous, then sero-purulent, and ultimately purulent, according to the progress of the inflammatory process. Sometimes the fluid is mixed with blood. The tumour is distinctly fluctuating, and very painful to the touch. There is acute œdema of the superimposed and surrounding tissue ; the skin is red and tender ; and, not unfrequently, this superficial affection assumes the erysipelatous character, especially when the result of a punctured wound. The lining membrane becomes successively congested, turgid, infiltrated, increased in vascularity, and coated by plastic formation ; ultimately it ulcerates, the contents escaping towards the surface.

Treatment consists, in the first instance, of ordinary antiphlogistic

means—as rest, leeches, fomentation, aconite, antimony—with a view to restrain the inflammatory process. If successful, the serous fluid soon disappears by absorption ; as acute dropsy usually does, on subsidence of the affection by which it was produced. If it linger, slight discutients will be sufficient to complete its dispersion. When, however, resolution has not been effected, and suppuration has occurred, we need have no hesitation in treating the case as an ordinary acute abscess ; by free, early, and direct incision. Temporary aggravation may follow infliction of the wound ; but this is met in the ordinary way ; and, on its subsidence, healthy granulation will, under suitable treatment, advance towards satisfactory cicatrization—the cavity becoming obliterated.

When the bursa is in connection with, or in the close vicinity of an important articulation, our antiphlogistic efforts must be doubly energetic and anxious ; to avert, if possible, involvement of the more important part. And when suppuration has occurred in such a bursa, incision should invariably be both early and free.

Chronic Bursitis, a very common result of moderate and habitual pressure, produces a slowly increasing swelling, dull, and almost painless ; without either superficial cedema, or redness of integument. The contents are usually thin and clear, sometimes mixed with blood in a diffused or coagulated form.

Treatment consists chiefly in abstraction of the cause, and in the employment of discutients ; as blisters ; mercurial plaster, or equal parts of the gum and mercurial plasters ; iodine, in form of ointment or of strong solution ; gentle support, by bandaging. Such means prove successful, when patiently and duly employed, in the great majority of cases.

Should they fail, then the treatment may be as for hydrocele ; drawing off the fluid by a trocar, and injecting a small quantity of the solution of iodine. After evacuation of the contents in the superficial bursæ, the application of a blister will usually prove sufficient to excite the necessary stimulation.

Sometimes the cyst of the bursa becomes thick, indurated, and otherwise altered in structure. In such cases, resolution is not complete ; more or less hardness and swelling continue, in spite of the most active and persevering discutient treatment. Unless the symptoms prove unusually troublesome, however, severer remedies—as by excision—are scarcely warrantable.

Sometimes not only is the cyst much thickened, the interior is also filled by a plastic formation, more or less completely organized. Such a state is obviously not amenable to discussion ; and may be safely treated by excision.

Sometimes the cyst slowly suppurates. The chronic abscess may perhaps be discussed ; more probably, it reaches the surface and is discharged. Even free incision may not be followed by satisfactory closure ;

Fig. 165. Enlarged bursa over the patella ; the result of pressure. Housemaid's knee.



Fig. 165.

an indolent purulent pouch remaining, filled only by ill-formed pus, and granulation proving deficient.

Again, small adventitious bursæ not unfrequently open by suppuration; and then remain open; continuing to discharge a thin fluid, partly bursal, partly purulent, through an irritable sinus, which terminates in a more irritable ulcer, as in open *Bunion*. The best mode of getting rid of such troublesome affections is to insert a pointed piece of potassa fusa; applying it freely to the whole of the secreting surface. A slough is formed, including the adventitious structure; and, on its separation, healthy granulation and closure will ordinarily follow.

Small adventitious bursæ may be chronically enlarged, and be themselves the seat of little pain or uneasiness; while from a red, glazed, and intensely irritable state of superimposed skin, the patient may from time to time endure extreme suffering—as in the slighter form of bunion. In such cases, total abstraction of pressure, and the application of nitrate of silver so as merely to blacken and desiccate, will generally suffice to restore a state of indolence and quietude.

Loose Bodies in Bursæ.

These bodies, resembling in size and form melon seeds, are sometimes found in bursæ. Their existence in this situation is, however, rare as compared with their formation in the distended thecæ of tendons. When the bursal swelling consists of two prominent parts, with a narrow channel of communication, these bodies produce a peculiar churning sensation, on pressure being made alternately on one swelling and on the other. When this is not the case, their presence cannot usually be determined until the sac is punctured; when either they may escape along with the serosity, or the opening being too small for this, a few drops of serum only escape, and the swelling remains undiminished even on steady pressure. If troublesome, they may be removed. By direct incision, if the bursa be insulated and small; by subintegumental puncture, and extrusion, when the bursa is large, or connected with a joint.

AFFECTIONS OF THECÆ.

Thecitis.

The thecæ of tendons may be acutely affected by the inflammatory process; in connection with rheumatism or gout, or in consequence of external violence. More frequently the process is chronic; the slow, and perhaps remote consequence of a blow or strain. A fluctuating swelling forms, with little pain; but with a marked feeling of uneasiness, as well as of weakness in the part; the play of muscles, tendons, and sometimes of the neighbouring joint, being manifestly impeded.

Treatment is by rest, pressure, and discutients. If the rheumatic or gouty diathesis be present, the ordinary remedies—as colchicum, iodide of potassium, etc.—are of course to be employed.

Loose Bodies.

These are much more frequently found in thecal than in bursal cavities. They are seldom single ; and may be very numerous. Commonly they are of uniform appearance and size, like barley-corns or melon seeds ; of much softer consistence than the analogous formations in joints ; most common in the thecæ beneath the annular ligament of the wrist ; floating in a thick, glairy, but clear fluid ; and causing much inconvenience by swelling. On manipulation, during slight motion of the part, a characteristic crackling, grating, or churning sensation is imparted to the touch.

Removal by direct incision will certainly be followed by an intense inflammatory attack. Suppuration, with much constitutional disturbance, can hardly be avoided ; and it is probable that, on ultimate subsidence of the inflammatory process, much change of structure will be found to remain, probably impairing the function of the part more seriously than did the previous swelling. Such loose substances, therefore, should not be interfered with by operation, unless when especially troublesome ; and then the subcutaneous and valvular method of incision will probably be most expedient. Nor, when numerous, should an attempt be made to remove them all at once ; otherwise atmospheric entrance is likely to take place, bringing on the dreaded inflammatory mischief. By repeated punctures, however, they may at different times be safely extruded. Should suppuration occur, we must unhesitatingly make a free and direct incision ; and if any constriction in the sac exists, then, by the introduction of a probe-pointed bistoury, this should be subcutaneously divided, so as to secure a free communication with the upper part of the sac, which will also suppurate. When the theca beneath either the anterior or posterior annular ligament of the wrist is affected in this way, the opening of the sac in the palm, or above the wrist, should be completed by subcutaneous division of the annular ligament by the introduction of a curved probe-pointed bistoury along the channel of communication.

In France, tapping of the part and injection of tincture of iodine, is practised ; as for hydrocele.

Ganglion.

This term is often applied to the diffuse chronic collections in thecæ. But, perhaps, it is more correctly limited to the distinct, circumscribed, and prominent, though small collections, which so frequently occur at the wrist and ankle, particularly in the former situation. The cyst is translucent ; the contents are thick and clear, usually like "*Macgilp* ;" and the swelling, though tense, distinctly fluctuates. Sometimes no cause can be assigned ; in other cases, the origin is attributed to a strain. Females are more frequently affected than males. Mere deformity may be the result ; or there may also be weakness, with occasional pain.

The indication of cure is very simple ; to extrude the contents from the interior of the cyst, to disperse them into the surrounding areolar

tissue, and to promote their gradual removal thence by absorption. For this purpose, it is necessary to make an aperture in the cyst. If the formation be recent, pressure will be sufficient to rupture the parietes and to produce diffusion. On applying the thumb, or thumbs, energetically to the part, the cyst is felt to give way ; the tumour collapses ; by pressure and friction continued, the contents are completely expelled ; and then either moderate pressure is maintained, by compress and bandage, to prevent re-accumulation, while occasional smart friction is also used to favour absorption ; or a blister is applied over the part to excite a sufficient degree of irritation within the sac. If thumbs fail, the part may be struck by any hard substance. Or a fine knife, such as used for division of the iris in the operation for artificial pupil, or for subcutaneous section of tendon, may be introduced at one or more points, to puncture and divide instead of rupturing the cyst ; the instrument being cautiously withdrawn so as to prevent the entrance of air.

CHAPTER XV.

DISEASES OF THE ARTERIES.

ARTERITIS.

THIS term denotes the inflammatory process affecting the arterial tissue ; and may be either acute or chronic. Formerly, when exudation was presumed to constitute the essential characteristic of the inflammatory process, the absence of blood-vessels from the internal and from the deeper layers of the middle coat of the artery, was supposed to present insuperable difficulties to the occurrence of this disease in the arterial tissue. Now-a-days, however, we regard the artery quite as susceptible of inflammatory structural change, as the heart is to endo- and myocarditis.

Acute Arteritis.

The acute form may be limited to one portion of an artery ; or it may be of a spreading kind.

1. *The Spreading.*—This is of comparatively rare occurrence. The patient is beyond the middle age, and of broken constitution. The disease is seldom limited to one vessel, but pervades a large portion, or even the whole of the arterial system of the part affected. Except the aorta, the arteries of the limbs, especially the lower, are the vessels most frequently involved. The symptoms are obscure, and apt to be mistaken for those of rheumatism. There is much constitutional disturbance, as can readily be understood, of a febrile kind ; but not shewing the usual sthenic signs of true inflammatory fever ; partaking more of the irritative and sometimes of the remittent type. The tracks of the main vessels affected are painful ; and pain is increased by pressure and motion ; induration, too, is felt ; the pulse is feeble, and has a peculiar thrilling stroke ; its impulse gradually diminishes, and ultimately it wholly ceases in the part. The superimposed soft textures are seldom involved ; the skin remaining pale and otherwise normal in its appearance. The effects on the arterial coats are turgescence and cell proliferation, producing thickening and fusion of the different coats, affecting either the internal coat alone, or all the coats together, attended more particularly with loss of the smooth serous character of the healthy internal tunic. It becomes thickened, sclerosed, and cornea-like in appearance ; the deeper parts look more opaque than its surface ; and where they abut upon the middle coat, well-marked pultaceous atheromatous degeneration ensues in the proliferating connective tissue. The fibrin of the circulating blood, meanwhile, coagulates, and adheres to the changed tube ; so that ultimately the canal is wholly occluded.

in proportion to the obstruction of circulation, which necessarily results from the progress of such change, vital power in the parts beyond the obstruction is very much impaired; both temperature and sensation are diminished; and should stimulating measures be unwisely adopted to restore these, excitement beyond the power of control is almost certain to be induced, and gangrene follows. Indeed, if the obstruction be both complete and general in a part, its death will surely happen as the direct result—a simple cessation of vitality, without intervention of the inflammatory process. On the other hand, in slighter cases, the original affection may subside ere yet consolidation has been complete; the obstructing coagulum may be gradually removed, and circulation with vital power restored.

The treatment of such disorder, when detected, ere obstruction of the circulation has occurred, will consist of leeching along the affected course, rest, and ordinary antiphlogistics. A tolerably free administration of calomel and opium may also be desirable, to prevent further change of structure, if possible. Opium, after depletion, will in all cases be suitable; not only as relieving pain, often severe, but likewise tending to maintain tone of the arterial system; and ammonia may also be given with propriety. Subsequently to the occurrence of obstruction, mercurial or other sorbefacients—with a view to gradual removal of the obstructing coagulum—are worse than useless. All stimulating applications, too, whether external or internal, more especially the former, must be carefully avoided; lest the untoward result of excitement exceeding power be induced in the enfeebled parts. Ultimately the circulation at the extremity, through the medium of collateral vessels, becomes completely re-established.

Arterial obstruction from inflammation is liable to be confounded with *embolism*. In the latter, however, the obstruction occurs suddenly, completely, and is attended with acute pain.

2. *Limited Arteritis*.—This is a very common result of external injury done to the tissue; as by wound, or by application of ligature. Various results may ensue, corresponding to the amount of the inflammatory process induced. The minor grades will give a plastic result, such as we desiderate after deligation; the coats become turgid and coherent; and the canal is compactly obliterated at the part affected. A higher grade gives suppuration, usually conjoined with ulceration; a result which we do not desiderate, but on the contrary take every means to avoid, in operations on the larger vessels—except in the part immediately in contact with the noose of the ligature, where ulceration is inevitable. A still higher grade, more especially if conjoined with circumstances tending to impair vital power in the tissue, causes sloughing of the vessel; a more disastrous event; exemplified by deligation of an artery whose coats have been too rudely manipulated, and too extensively separated from their connections.

The best treatment of this form of arteritis consists in so conducting our direct interference with the vessel, that only the minor grade of the inflammatory process shall be obtained, whose characteristic is plastic change, with obliteration of the canal at the affected point.

In the asthenic form of this process we have no plastic change, do what we will.

Chronic Arteritis and Arterial Degeneration.

This is of infinitely more frequent occurrence than the acute ; and usually idiopathic. It seldom occurs till after the middle period of life ; is more frequent in males than in females ; and its accession would seem to be much favoured by a shattered state of constitution, more especially when this arises from intemperance, syphilis, or the abuse of mercury. It is frequently associated with hypertrophy of the left ventricle of the heart.

Acute arteritis may be said to be chiefly connected with injury of the arterial tissue ; the chronic, with its disease.

Chronic arteritis is gradual and insidious in its progress ; marked by slight pathognomonic symptoms ; and seldom discovered, during life, but by its ulterior results—abnormal dilatation of the artery, and formation of aneurism. The structural change, however, is insufficiently marked ; distinguishing, as we can in it, “a stage of irritation preceding the fatty metamorphosis, and comparable to the stage of swelling, cloudiness, and enlargement which we recognise in other inflamed parts” (*Virchow*). It may

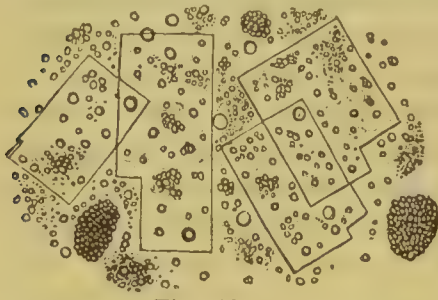


Fig. 166.

affect an artery throughout its whole extent, continuously ; or it may occur only, or at least mainly, in patches ; and such patches are usually situate in the vicinity of bifurcations, or at the origins of large arterial branches. The internal coat is thickened, spongy, and less smooth and polished in its surface, due to cell proliferation of its connective tissue. Between this and the middle coat—in the intermediate tissue which is sometimes termed the sclerous coat (*Malgaigne*)—a soft caseous-looking substance forms, in granules or patches, usually termed *atheromatous*, and, according to recent researches, composed mainly of fatty granules and flakes of softened tissue, associated with crystals of cholesterine, in large rhombic plates and fine rhombic needles—the result of a fatty degeneration of the products of a preliminary process of cell proliferation. Ultimately the middle coat, too, is altered ; becoming thick, yellow, and opaque ; its fibrous tissue undergoing more or less fatty change, while the external coat becomes thickened and more vascular. In consequence of such change, the arterial tissue is found to have its elasticity much impaired ; and is unable to accommodate itself to the play of extreme motion, as before. The cohesion of its middle and inner coats is diminished ; and, if forcibly stretched, these are apt to tear. They are incapable, too—comparatively, sometimes actually—of plastic change ;



Fig. 167.

Fig. 166. Fatty granules, with crystals of cholesterine, from atheromatous change in the aorta.—BENNETT.

Fig. 167. Arterial atheromatous degeneration of the aorta, above its bifurcation. Ulceration in progress.

and if a tear do take place, this is not likely to undergo repair. On the contrary, the breach is more likely to widen by ulceration ; for proneness to that morbid result is another consequence of the structural alteration. Hence it will at once appear, how an artery so circumstanced is but little fitted for deligation. Occlusion will not take place by sound plastic change ; but rather by ulceration the unobstructed canal will be opened to, and dangerous hemorrhage necessarily ensues. It is also equally plain how the occurrence of aneurism is favoured, by the proneness to ulceration in the middle and inner coats, and by the impairment of their elasticity, cohesion, and plastic power. Dilatation, rupture, and non-repair of the breach, are obviously rendered liable and likely.

It must be borne in mind, however, that the advanced atheromatous change in arteries may be due not to any inflammatory process of cell proliferation, which ends in decay and fatty degeneration of the adventitious corpuscles, but to a simple fatty degeneration of the arterial tunics, commencing in the corpuscles of the connective tissue of the internal coat. Afterwards the intermediate substance also softens ; and the fatty granular masses breaking up, are carried away in the wash of passing blood, leaving the serous surface irregular and even flocculent. This fatty degeneration may also occur primarily in the sclerous layer of the arterial tunics, or in the muscular or elastic tissues of the middle coat. And it is in these last-mentioned cases, that, forming a pultaceous softened mass, it most closely resembles the conditions resulting from inflammatory change.

Calcareous change may follow or accompany both conditions just described. In the one instance, the inflammatory irritation first occurs, characterized by proliferation of the pre-existing connective tissue. Thus, swellings of the internal coat are produced ; in which, however, the calcareous deposit does not take place for some time ; and when it does, the result is the formation of true osseous tissue in plates in the inner coat of the vessel at the affected part. In the other instance, the deposit is a mere calcareous degeneration of already existing and un-irritated connective tissue, which simply undergoes petrification. This form is usually a concomitant and result of old age. As the arcus senilis forms on the cornea, as the body bends, as the prostate enlarges, as the teeth drop out, and the cartilages ossify, so the arterial tubes are liable to become hard and non-elastic, by the formation of earthy matter in the sclerous and also in the middle coats ; sometimes in granules, more frequently in scaly patches, sometimes in continuous masses. The internal coat is dry and wrinkled in appearance ; sometimes loose and almost flaccid in its surface ; sometimes torn, shrivelled, and raggedly projecting ; not unfrequently the calcareous scales are incorporated with it. Very often atheromatous may be seen mingled in greater or less proportion with the calcareous matter, in the artery of the old man. And sometimes a few calcareous scales may be found among atheromatous formations, in the artery of the man of middle age. The calcareous change is ordinarily termed ossification ; but, in most instances, the process and result are altogether different from the formation of true bone. Sometimes it is so extensive as almost to banish all trace of the original structure of the vessel, converting it into a rigid earthy tube.

This degenerated state must obviously interfere with the elasticity and

plastic power of the tissue. Yet aneurism more seldom follows upon this than on the atheromatous change. It is probable that cohesion is less impaired, and ulceration less liable. Also it is plain that, in consequence of this earthy change occurring most frequently in advanced age, when muscular effort is much less sudden and extreme than in younger years, one of the most common exciting causes of aneurism is not likely to be in operation. Calcareous degeneration seldom occurs, to any extent, before sixty years of age. But the period of proneness to aneurism is found to range between the ages of thirty and fifty—the period of muscular exertion, exposure to hard living, and liability to atheromatous degeneration of the arterial coats.

Both forms of change may be said to be limited to the aortic system. The pulmonary is almost wholly exempt.

Virchow has particularly directed attention to another and no less important form of arterial degeneration—the *Amyloid*. This degenerative change occurs primarily in the muscular fibres of the inner part of the middle coat. “First of all the place of every fibre cell is occupied by a compact homogeneous body, in which the centre of the nucleus still appears as an aperture, but by degrees every trace of cell structure disappears, so that in the long run only a spindle-shaped body remains, which possesses no apparent membrane, nucleus, or contents. This change ultimately pervades whole tracts of tissue, and ultimately the vessel walls become transformed into a mass which is homogeneous, compact, shining, colourless, and very friable” (*Virchow*).

The chief importance attachable to this change is, the diseased condition which it induces in the tissues nourished by such afferent vessels, producing in these a similar state known as amyloid, waxy, or lardaceous degeneration—well seen in the liver, spleen, kidneys, and lymphatic glands.

For the calcareous and amyloid degenerations we can do nothing. When the atheromatous is suspected, all stimuli should be abstracted, and the diet carefully and temperately regulated; sudden and great muscular exertion should also be avoided, as well as mental excitement or other causes likely to occasion hurry of the circulation. If inflammatory symptoms coexist, and the rheumatic diathesis be present, or the system have suffered by syphilis or mercury, means must be taken to counteract these states; not so much with the object of removing the pathological results which have already occurred, as with the view of checking further change. If need be, the force and rapidity of circulation may be controlled, by digitalis, aconite, or other sedatives on the heart's action.

Aneurism.

By this term is meant a pulsating tumour; composed of a cyst, which is filled with blood, partly fluid, partly coagulated, and whose cavity communicates with the arterial canal.

Various divisions have been made of this important subject. The most ordinary is into the *True* and *False* Aneurisms. But these terms, having come to bear so many and diverse meanings as to lead to much practical confusion, it may be well to supersede them by others less liable to be mistaken; and we shall therefore speak, rather, of *Spontaneous* or

Idiopathic Aneurisms, in contradistinction to those which are *Traumatic* or otherwise *Accidental*. By the first we mean those which are the result of disease of the arterial tunics ; the-tumour being formed by dilatation, or in consequence of the arterial coats having given way from within, either by rupture or by gradual disintegration ; and the cyst consisting, at least in the first instance, of a portion of the arterial coats yet unbroken. By the latter, on the contrary, we shall understand those aneurisms in which the arterial tunics form no part of the aneurismal cyst ; these having been wholly divided, either by wound or by ulceration from without ; and into the formation of which aneurisms, the existence of antecedent arterial disease does not necessarily enter.

Idiopathic Aneurism.

The mode of formation may vary. 1. *By Dilatation*.—This is most frequent in the aorta. The coats do not give way, either by rupture or by ulceration, but evenly dilate into a pouch of greater or less volume ; in the parietes of which atheromatous change is apparent, and the continuity and integrity of the tunics can be distinctly traced—more especially after maceration. The elasticity of the vessel has been considerably diminished by the atheromatous change ; and in proportion to its diminished elasticity, is the loss of compensating power to cope with the pressure produced by the current of blood impelled by the heart. The vessel accordingly remains dilated, and this form of aneurism is obviously dependent on changes affecting especially the elastic and muscular fibres of the middle coat, and not on degeneration of the inner coat, whether primary, or secondary to inflammatory proliferation. The dilatation may be partial, on one aspect of the canal ; and the hollow swelling which results is then said to be Sacciform. Or the whole tube gradually dilates, and gradually recovers at each end of the dilated part, giving rise to a spindle-shaped enlargement, which is termed Fusiform. Or the general dilatation may be abrupt and uniform ; and it is then said to be Cylindroid.

2. *By Dilatation and Læsion*.—In this form, commencement of the tumour and abnormal cavity is made by dilatation of all the coats, which, however, may not proceed to any great extent. Then the internal coat gives way, either by gradual disintegration of the tissue, or by sudden tearing during some muscular exertion ; the middle coat usually yields at the same time ; blood in consequence becomes insinuated into the aperture ; the external coat yields before the pressure from within, and, expanding, forms the aneurismal cyst. The coats around the læsion become intimately adherent by plastic change, preventing the stripping up which otherwise would be liable to occur, and favouring the thickening and rounding off of the edges of the aperture. The new cavity is filled by fluid blood ; and, under the impulse thence received, the cyst gradually enlarges ; receiving strength and addition both from without and from within. From within, by deposit of fibrin from the blood, and by its own inherent nutritive power determining cell proliferation of the connective tissue in the external coat ; from without, by condensation and incorporation of the surrounding tissues. By such condensation and organization of part of the fibrin from within, with plastic contribution also from the living texture,

he interior of the cyst may come to be lined with a quasi-membranous structure ; analogous to, and often apparently continuous with the internal coat of the artery. Resistance to enlargement of the tumour is made partly by this strengthening of the cyst, partly by the contractile effort of repression exerted by the surrounding tissues.

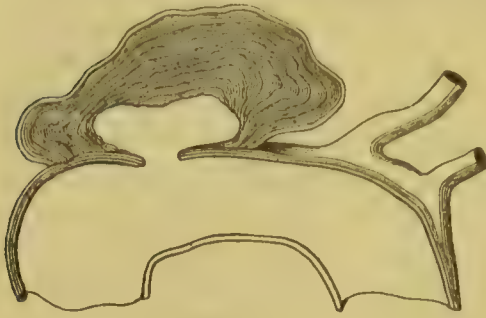


Fig. 168.

The first part of the process of formation is gradual and slow. But on the coats giving way, increase is sudden, and for a time rapid ; often the patient has, by sensation in the part, a distinct perception of the event.

This is a frequent form of idiopathic aneurism, especially in the extremities.

3. *By Rupture.*—This kind of tumour forms rapidly from the first ; and may in a short time attain a large size. The immediate or exciting cause is sudden muscular exertion, as in pulling, leaping, etc., whereby the arterial tunics are stretched beyond what they are able to bear. The internal and middle coats give way at once, by laceration ; and aneurismal formation speedily follows. The patient has generally a distinct perception of the tear, and consequently of the very first origin of the tumour. Sometimes the event occurs during ordinary exertion of walking ; and then he is apt to suppose that he has been struck on the part, by a stick or stone. But this exciting cause is not alone sufficient ; there must be a predisposing one also ; and that is the atheromatous change. Were it not for this, the tear might simply heal ; or, at all events, plastic product would be formed, whereby the arterial tube would be obliterated ; and either way, there would be no aneurism. But when arterial degeneration exists, no such reparative effort is made ; on the contrary, the tear widens, and the aneurismal formation advances.

Other terms are used to denote varieties in character or form. For example, we say that an aneurism is Dissecting, when the arterial tunics are more or less separated from each other by the blood's infiltration. The external coat alone may be detached from the middle and internal. Much more frequently, however, the transverse fibres of the middle coat are separated into two layers, for a greater or less distance, in the track of the vessel.* Also, the dissection may be either complete or partial. That is, the hiatus between the coats may terminate in a

* For most practical purposes, it is enough to regard the arterial tissue as consisting of three layers—internal, or serous : middle, or fibrous : and external, composed mainly of connective tissue. But microscopically, the number of layers may be multiplied. The following are recognised by Henlé :—1. The epithelial. 2. The striated, or fenestrated membrane. 3. The longitudinal fibrous. 4. The circular fibrous. 5. The yellow fibrous, or elastic. 6. The areolar (connective tissue). By Malgaigne the *Sclerous* is described as a separate tunic ; it is, however, nothing else than the subserous muscular coat, in which the degenerative changes already described first occur.

Fig. 168. Aneurism of the aorta. The greater part of the cyst filled with clot. Aperture of communication small.

blind sac, where blood stagnates, or whence rather it will regurgitate. Or the dissection may be complete ; there being a second aperture of communication with the artery, at the extremity of the hiatus, through which the stray current of blood again joins the main stream. Such dissections may be of slight extent, or they may occupy several inches of the vessel. The variety is of comparatively rare occurrence ; and is seldom found affecting any artery except the aorta.

It is useful to remember that the aneurism is sometimes connected with the artery by means of a *narrow neck* of considerable extent, instead of the abnormal cavity being bluffly set upon the normal tube. The fundus of the pulsating tumour may consequently project several inches from its arterial origin ; and, in certain situations, as at the root of the neck, diagnosis is thence rendered obscure. An aneurism there may seem to be of the *innominate*, or of the first third of the *subclavian*, while in truth it is of the *aorta*. Such a tumour is said to be *Pedunculated*.

Aneurism is also said to be either *Limited* or *Diffuse*. In the one case it is bound within the limits of a proper cyst ; in the other, having either burst through this, or been originally devoid of it, blood is widely diffused by infiltration into the surrounding tissues.

The idiopathic aneurism is at first invariably limited ; but it may become diffuse by giving way of the cyst, from disintegration or laceration. The occurrence is always secondary. In traumatic or accidental aneurism, on the contrary—dependent on læsion not originated by disease in the arterial tissue—the form may be diffuse or not at first, according to circumstances. If the escape of blood be sudden, great, and violent, no distinct restraining cyst can form ; infiltration is wide and free ; and the diffuse variety may be said to be at once established ; or rather, perhaps, the case might be termed one of internal hemorrhage, with infiltration—likely to choke circulation of the limb, and threaten mortification. Or the escape of blood from the wound being less intense and copious, a cyst forms by condensation ; which subsequently may give way, however, under some fresh exciting cause ; and then, as in the idiopathic form, the “diffuse” condition is secondary—sometimes for weal, more frequently for woe.



Fig. 169.

Fig. 169. Aneurism, of a double cyst. The first had given way ; the tumour then became diffuse ; but the second cyst formed, of non-arterial tissue.—Sir C. BELL.

Traumatic or Accidental Aneurism.

In the traumatic form, as already stated, the aneurismal cyst is not composed of any of the arterial coats, but entirely constructed from the tissues exterior and adjoining to the vessel. 1. Most frequently, it is the result of wound; all the coats being at once perforated; blood escaping in considerable volume and force, and thereby condensing for itself a cyst; the cyst subsequently becoming strengthened, yet dilating in the ordinary way. 2. Or it may be the result of laceration; as in fracture of the limb. Or it may occur independently of fracture; as by the employment of undue force in reducing dislocation. The main artery is torn, either partially or completely. Profuse hemorrhage is the result, which, finding no external outlet, infiltrates the neighbouring soft parts, or perhaps distends them to form a large bloody pool. The arterial aperture does not heal, but, remaining patent, establishes a permanent communication; and so the diffuse form of aneurism is produced.

3. Accidental aneurism may occur in another way; by læsion irrespective of traumatic injury, yet quite external to the arterial coats. These may be perforated by ulceration from without. An abscess forms in the immediate vicinity of an arterial trunk. Evacuation is delayed; and spontaneous approach to the surface is repressed by fibrous investments. The cavity of the abscess enlarges deeply, and compresses the arterial tissue. This at first bends before the pressure, and is besides protected by plastic product, which seems as if specially provided for this end. But, as the abscess continues to enlarge and pressure to increase, the utmost limit of accommodation on the part of the artery is reached; and its tissues, themselves now involved in the suppurative change, at length give way by ulceration. The arterial canal becomes continuous with the cavity of the abscess, through an ulcerated aperture, perhaps of no great size; the cavity, formerly filled with pus, becomes occupied by blood; and what was an abscess, has become an aneurism. One obvious advantage of the narrow aperture of communication is, that the pus is gradually, and not at once, brought into the general circulation—for a time, probably, continuing to whirl in turbulent motion within its own cyst; and thus the system may be saved from those formidable symptoms which might follow any considerable and direct admixture of pus with the circulating mass of blood. A memorable example of this form of the disease was afforded by the hospital experience of Mr. Liston (p. 182). It is only fair, however, to state that this mode of formation of an aneurism is denied by several practical surgeons. These acknowledge that an artery exposed in the sac of an abscess frequently gives way by ulceration, after the opening of the purulent collection, but deny that any communication, as above described, of the arterial channel with the abscess sac, ever forms antecedent to such opening.

A case once occurred in my hospital practice which seems to bear strongly on the point. A woman was stabbed in the arm, by means of a blunt knife, and lost much blood at the time. About eight days afterwards, the wound being in an ulcerating state, serious hemorrhage occurred; and, cutting into the part, I secured two bleeding arterial points by ligature. After this, the wound healed kindly though slowly,

from the bottom ; and the woman was discharged with a *firm, depressed cicatrix*. About a fortnight afterwards, however, she returned with a large false aneurism occupying the whole of the upper part of the arm, and restrained from bursting only by the thin translucent pellicle of the cicatrix. Through this the dark interior could be seen. No time was to be lost ; and the ordinary direct operation was performed, with a successful issue—the ulnar artery being found open, about an inch below where the ligature had been applied in the first instance. The woman, it seems, had resumed laborious occupation immediately after dismissal ; and very speedily a throbbing was felt in the arm, such as is usually thought symptomatic of suppuration. She believed that matter had formed, and that it would follow the ordinary course of an abscess ; but became alarmed by afterwards observing a general pulsation of the arm, on account of which she once more sought hospital relief. Such a history seems to point to suppuration, and subsequent arterial communication with the abscess, as the sequence towards this aneurismal development.

The most common example of traumatic aneurism is that which follows accidental wound in venesection, at the bend of the arm. The mistake is usually at once discovered, and means taken to avert the consequences ; by energetic and direct pressure on the part. Blood in consequence escapes but slowly from the wound in the artery. By the pressure, it is prevented from being discharged externally. It slowly accumulates, therefore, in the areolar tissue, exterior to the artery, and beneath the fascia of the fore-arm. This tissue becomes condensed into the form of a cyst ; which, as in idiopathic aneurism, receives corroborating addition both by deposit from the blood, and by amalgamation of other tissues on its outer surface. The internal additions incorporated with the original cyst, and fully organized, acquire from pressure a compact structure, and constitute a lining membrane, smooth, and serous-looking ; often seeming, as in idiopathic aneurism, to be continuous with the internal coat of the artery. The coagulum contained within the cyst is always, however, loose and dark-coloured ; and such aneurism never contains the dense, concentric, laminated, fibrinous coagula, which are so frequently met with in the idiopathic form of the aneurismal sac. The cyst of the traumatic aneurism may ultimately give way, and the aneurism become diffuse ; but this is by no means probable, seeing that the cyst is powerfully strengthened by the investing fascia of the fore-arm.

When remedial pressure is either absent or imperfect, the bloody swelling may be large and diffuse from the first. The coagulum is seldom dense throughout, in either the diffuse or the circumscribed variety ; but often has a central space or canal, continuous with the arterial aperture.

By some it is supposed that the aneurismal formation is different from that just described. That the escape of blood, with formation of an exterior cyst, is not immediate ; but that the aperture in the vessel is first filled up by a membranous formation ; and that this, yielding before the blood's impulse from within, gradually dilates and forms the aneurismal sac. Such a mode of formation must be very rare.

In whatever way formed, the traumatic aneurism has one very impor-

tant practical characteristic ; namely, a formation quite independent of arterial degeneration. In consequence, we have it in our power to deal remedially with the tumour itself ; expecting to find the arterial tunics there as sound as at any other part.

Symptoms of Idiopathic Aneurism, Circumscribed.

This being by much the most frequent form of aneurism, its symptoms may be regarded as descriptive of the disease in general. We are also to be understood as mainly referring to aneurisms which are external to the great cavities of the body, and consequently amenable to surgical treatment.

There is a swelling, at first small, but gradually increasing ; originally soft and quite compressible, the cyst being as yet filled only with fluid blood ; ultimately hard, and incapable of being made altogether to recede, its interior having become occupied by a greater or less amount of solid fibrous deposit. But however great the diminution, or however complete the disappearance may have been under pressure—so soon as this is removed, there is an immediate and forcible return to the former dimensions. In the tumour there is distinct distensile pulsation from the beginning ; appreciable by both sight and touch, but more especially by the latter ; synchronous with the heart's impulse ; equally felt in all aspects of the tumour ; increased by pressure on the distal side ; diminished, or perhaps wholly arrested, by pressure on the cardiac side of the tumour. At each impulse, there is not only elevation of the tumour, but distinct expansion of it at every point. The more firm the pressure applied, the more distinct the impulse, and the more evident the simultaneous effort of enlargement. At the same time, a very expressive thrill is imparted to the compressing hand ; and if the ear be applied, mediately or immediately, a *bruit de soufflet* will be heard more or less distinct. The bruit, however, it is important to remember, is not an infallible indication of the presence of aneurism. Pressure on the artery, by the stethoscope, or by any tumour, may induce it ; and it is also found, when no structural change exists, seeming to depend on an impoverished and deficient state of the blood—as in anæmia. It may, however, safely be concluded that in all external aneurisms this symptom exists ; and, therefore, in any pulsating tumour where there is no *bruit* present, a shrewd suspicion that it is not aneurismal should be excited.

The tumour's growth is steady ; seldom in idiopathic aneurism so rapid as the outward bulging of an abscess ; seldom so tardy as the enlargement of any solid tumour, not malignant. Pain is complained of ; not so much on account of structural changes in the artery itself, as in consequence of subsequent interference with the adjoining textures, as the enlarging tumour encroaches on them. And sometimes, in what may be termed acute aneurisms, the suffering is really excruciating. A patient under my care in the hospital, affected with acute inguinal aneurism, expressed himself as enduring constant agony in the thigh and knee ; and urgently demanded relief by operation. This was delayed, in the hope of finding both part and system in a more favourable condition, after suitable treatment. But meanwhile, the poor man, in a mingled

phrenzy of delirium and despair, sought an end of trouble by thrusting a corkscrew into the centre of the tumour.* He had great fear of dying; but pain, by its intensity, overcame the fear of death, and drove him to suicide. The pain, be it remembered, is not only or always complained of as existing in the situation of the aneurism; it frequently affects, or extends to, parts beyond. In popliteal aneurism, for example, the heel is very frequently complained of as the site of pain.

Pressure on the passing nerves causes not only pain, but numbness and swelling also, of the lower part of the limb. By pressure on the veins and lymphatics, congestion is induced; causing more or less œdema, by which the limb is swollen and discoloured. From the same cause there is physical weakness, diminution of temperature, and impairment of function. And let it never be forgotten, that vital power—the power of resisting or controlling the inflammatory process, and averting its untoward results—is very much impaired.

Important organs in the neighbourhood may have their functions seriously impeded by the bulging of an aneurism. In thoracic aneurism, for example, compression of the air passages may threaten asphyxia; inanition may be impending, by obstruction of the gullet, and respiration may be obstructed by pressure on the recurrens acting upon the larynx.

The patient's own perception of the disease is usually most distinct. He sees and feels the living, beating tumour. But the period at which he first becomes aware of its presence is very various. If it have been formed by dilatation only, weeks or months may elapse, subsequently to its origin, ere it arrests his attention. If it have been produced by the second mode of formation, the first stage, by dilatation, may have passed unnoticed; but the aggravation by giving way of the coats is usually quite distinct. And, as already stated, when the disease has begun by sudden laceration of the tissue, the very instant of origin is noted and remembered by the patient.

As the tumour enlarges, the artery contracts on its distal aspect, and circulation is weaker there. Did the lower limb depend for its arterial supply wholly on the contents of the affected trunk, vital power would be brought much lower than it is. But the diminished volume of the main stream is compensated, by enlargement of the side channels. What is termed the collateral circulation—at all times existing—is amplified to atone for the deficiency. Collateral branches, arising above the tumour, enlarge; and, anastomosing with others from below, as they pass round the aneurism, pour their contents again into the main trunk. Some inches beyond the tumour, the arterial canal again shews its normal dimensions; and the general circulation of the limb is ultimately the same; only, at and around the tumour, it is partly direct and partly circuitous.

The tumour has not existed for any very long time before its contents begin to assume, in part, the solid form. Fibrin is deposited from the circulating blood, and becomes arranged in concentric laminæ within the sac. Part is incorporated with the inner surface of the cyst; becoming connected with it by both organic arrangement and vasculariza-

* Monthly Journal, April 1850.

tion. This goes to strengthen the cyst; and is quite distinct from the great bulk of the clot, which is loose in the cavity—as also from other concentric fibrinous laminae, with fluid blood playing round and sometimes through them. In consequence of this accumulation of solid fibrin, the pulsation and compressibility of the tumour are affected. The former may be somewhat less distinct at certain points than at others, according to the form and density of the clot; and if this be both dense and large, while the aperture of communication between the cyst and artery is small, little diminution of bulk may be effected even by energetic pressure. This state of matters, however, is no disadvantage; on



Fig. 170.

the contrary, it is by such change that spontaneous cure is accomplished. The fibrinous deposit, enlarging, may come to occupy almost the whole cavity; but still something more is wanted. If loose, with fluid blood playing around and between the dense concentric laminae, the cure is yet far distant. One step more is wanted. By agglutination of each layer to the others next it, and of the outer one to the cyst, the inner surface of the sac must be firmly glued to, and ultimately incorporated with, the fibrinous mass. Then the cavity is obliterated, the tumour consolidated. There is no room for any more entrance of fresh and fluid blood; this either passes on in its own proper channel, as in health; or, as more frequently happens, the solid tumour reacts on the arterial canal, bulging into it by gradual deposit of fibrin—obstructing its flow, and inducing ultimate obliteration at that point. There being no longer an impulse from within, the restraining influence from contractile efforts of the adjoining tissues is now unopposed; and thereby gradual subsidence of the

tumour, by absorption of the solid contents, is greatly favoured. Ultimately, by continuance of absorption, and absence of increase, almost all trace of the tumour has disappeared. The artery is usually found occluded at the site; but sometimes, though seldom, its canal remains still pervious (Fig. 170).

The occurrence of such a chain of events, however, is unfortunately rare. In the great majority of cases, unaided by our art, the fibrinous deposit is not agglutinated to the cyst, and consequently does not solidify the tumour, but merely acts as a partial restraint upon its growth;

Fig. 170. Aneurism, by dilatation. The abnormal space almost entirely filled up by fibrin; the arterial canal remaining clear. Spontaneous cure in progress; but, to the left, an important defect—the solid clot not yet incorporated with the cyst.

interposing itself between the cyst and the main arterial impulse, and thereby, to some extent, moderating the expansion of the aneurism.

As the tumour enlarges, the adjacent parts, more especially those in the direction of the principal increase, are displaced; and, as we have already seen, they may have important functions disturbed. And there is not only displacement and interruption of function; change of structure is induced. Part of the superimposed textures may become incorporated with the cyst; part is removed by absorption. Fibrous texture resists long; and may determine the increase in a lateral direction; while, by its unaccommodating resistance to the impulse beneath, much local pain, followed by constitutional disturbance, may result. Bone is more compliant; it cannot yield like the soft textures by elasticity; but it loses substance at the point compressed, by continuous absorption. Between the bone so affected and the aneurismal contents, there may be interposed the ordinary cyst, more or less attenuated by pressure: or that portion of the cyst may have been wholly removed, and its place occupied by the bone itself—the wave of blood washing the bare cancellated texture, without even a coagulum interposed.

As thus the tumour enlarges, in spite of resistance from superimposed parts—impulse and expansion from within proving paramount—the symptoms are not merely local; besides local pain, numbness, œdema, and more or less disturbance of function, according to the nature of the parts compressed, and the degree of their compression, the system is sooner or later involved in obvious irritation. This is to some extent due, and in very large aneurisms undoubtedly due, to the quantity of blood contained within the sac, and which, although retaining its vitality, is virtually cut off from and lost to the system at large. The stomach and digestion fail, sleep is disturbed, strength and flesh decline, the pulse becomes weak and frequent; in fact, the ordinary symptoms of constitutional irritation and anæmia are established—more or less urgent, in proportion to the resistance which is afforded, the importance of the parts to which pressure is applied, the size of the aneurismal sac, and the consequent quantity of its contents. By such general disorder the patient may be carried away—slowly exhausted.

If not, a great crisis is approached: the tumour having reached the integumental surface, or the border of a mucous canal, or a serous cavity. The last intervening texture gives way; and then the fatal result is seldom long delayed. The opening is effected in different ways. 1. On the surface, the same occurs as with abscess; a portion of the skin is attenuated, sloughs, and separates. 2. In a mucous canal, the aperture is made by continuous removal of tissue at the part most com-



Fig. 171.

Fig. 171. Aneurism of the descending aorta; burst. The patient died suddenly, in consequence.

pressed, by absorption—and latterly by ulceration. Or, it may happen, accidentally, that the progress of ulceration in the mucous membrane may be reversed. For example, an aneurismal tumour may compress the lower part of the trachea, threatening asphyxia; tracheotomy is performed, and a long elastic tube is worn in the wound; the extremity of that tube presses upon the apex of the aneurism, and by that pressure ulceration of the mucous membrane is induced; the ulceration continues advancing towards the aneurism, and so the latter's cavity may be exposed. Or, the pressure of aneurism on the œsophagus may be mistaken for the narrowing of that tube by stricture; and the use of bougies, causing ulceration in the bulging mucous membrane, may lead to a like calamity. 3. A serous cavity is opened, by attenuation of the serous membrane, from absorption under the continued pressure; and then laceration of the sac and serous membrane takes place at the attenuated part.

When, at any stage of its progress, the aneurism becomes diffuse, the symptoms are materially altered. Pulsation is diminished in consequence of pressure which is exercised on the arterial tube by the blood infiltrated around; and, when the infiltration occurs to but a limited extent, not exceeding what the general circulation of the part can bear, it may happen—all untoward circumstances remaining aloof—that thus the probability of spontaneous cure may be enhanced. Indeed, in some cases, we have no hesitation in attributing the origin of spontaneous cure to the occurrence of the diffused form. But it is more likely that the issue will acquire an untoward tendency by this event; the limb is endangered, and secondarily the system. The interruption to arterial flow, by rapid and profuse infiltration of blood into the general tissues, may be so great as at once to occasion gangrene of the limb. Or the arterial influx may be but partially interrupted; enough passing barely to maintain vitality at the first. By and by the inflammatory process begins in this part of weakened power, and, proving destructive in its results, produces not merely diffuse suppuration but sloughing. Nay, the whole limb may be struck with gangrene thus secondarily; and this is all the more likely, if local stimuli have been imprudently employed. Early amputation then affords the only prospect of preserving life. When part of the infiltration is superficial, discoloration of the integument necessarily attends; and let not this be mistaken for an indication of gangrene already established.

The *Fatal issue* of aneurism, then, may occur in various ways. 1. *By hemorrhage.* The intervening textures have all given way, as formerly detailed. A gush of blood follows establishment of the open condition. But this is not always at once fatal, especially when the aneurism opens on a mucous membrane, even in the case of the largest and most active tumours. A portion of the coagulum, becoming impacted in the orifice, for a time stems the flow. By and by this plug may be extruded or dislodged, and hemorrhage returns; again it may be arrested, and again return; and thus by repetition of bleedings, the patient is ultimately exhausted, and perishes.* Or death by bleeding may be altogether arrested; the clot remaining firm, and the mucous membrane healing over it—the

* It is remarkable what powers of arrest and delay Nature has in this particular. The late Mr. Liston died of aortic aneurism. In July profuse hemorrhage took place

aneurism not cured, however, but progressing to a fatal result in another way. 2. *By pressure on important parts*; as on the trachea, œsophagus, nerves, etc. Aneurisms of the arch of the aorta, for example, usually prove fatal by the injurious effect on respiration. 3. *By mere constitutional irritation*; the system sympathising with the local disorder. And, *cæteris paribus*, the greater the obstacles to the tumour's enlargement, the greater the amount of constitutional disturbance. Fibrous coverings oppose onward progress of the aneurism to the open state; but do not avert, though they may delay, the fatal issue. Ere hemorrhage has had an opportunity to occur, the patient may have been carried off by the wearing hectic. 4. *By suppuration of the sac*. The secretion of pus may prove great and protracted; and even amputation may fail to arrest exhaustion therefrom. 5. *By diffusion of the aneurism*; inducing gangrene of the limb, in the manner formerly explained. Typhoid symptoms may at once set in with force, and forbid the doubtful chance of amputation. 6. Lastly, the size of the aneurism may become so disproportioned to the powers of blood formation possessed by the frame, that although within the sac many pounds of blood may be contained, the patient dies from complete anæmia, with all the symptoms of gradual and fatal hemorrhage.

Diagnosis of Aneurism.

The Diagnosis of aneurism is one of the most important points in practical surgery. The following considerations will ordinarily enable us to escape from error. Chronic abscess, and glandular, medullary, or other tumours, are the morbid states most apt to assume the aneurismal characters. Often they simulate the disease very closely; strong and distinct pulsation being communicated by a neighbouring artery of large size.

But—1. By attending to the history of the case. Aneurism is soft and compressible from the first, and then becomes hard by solidification of its contents. An abscess may be soft from the first, but more frequently begins with induration, and softens secondarily; reversing the progress of aneurism. A small, chronic, and scrofulous abscess may be soft from the first; and may perhaps seem to be compressible. Situate, for example, in the groin, in the axilla, or at the root of the neck, it may seem to disappear in part by pressure, beneath the surrounding hardness; but on removal of the pressure, the lively resilience of the aneurism is wanting. An enlarged gland, or other tumour, is invariably first hard, then soft, and never capable of being dispersed by pressure; and, unless suppuration occur, the softening and fluctuation do not supervene at all.

2. Pulsation is equable in aneurism. At every point, unless much alteration by partial consolidation have occurred, pulsation is felt equally distinct. Whether the tumour is compressed directly downwards, or elevated and compressed latterly, pulsation is the same. A solid or other

from the windpipe; the aneurism had opened then. In December he sank under respiratory oppression; and there had been no bleeding during the interval—although, unhappily unaware of the disease, he had been habitually indulging in the most violent exercise. On dissection, three apertures were found communicating between the aneurism and trachea; each one not only firmly corked by its plug of fibrin, but also filmed over by a thin cicatrix.

swelling, not aneurismal, laid over the track of an artery, and receiving impulse from it, has a very distinct pulsation when the first mode of pressure is employed ; but when raised, and held by the sides, pulsation will be found either very faint or altogether absent.

3. Aneurisms of the large arteries have frequently a double impulse ; the first corresponding to the diastole of the artery ; the second taking place between it and the following diastole, and corresponding to the systole of the artery. Tumours which merely receive arterial pulsation exhibit only one impulsion, isochronous with the arterial diastole.

4. Pulsation of aneurism is felt from the first. Not so, in the case of swellings not aneurismal. At first these are small ; and, not encroaching on the vessel, they receive from it no impulse. Only after some time do they enlarge to such an extent as to be in close contact with the artery ; and then they receive its pulsation.

5. Aneurism has expansion co-incident with pulsation. The fingers placed firmly on the tumour diminish it more or less ; pulsation is felt increasing in proportion to the pressure employed ; and at each impulse there is a palpable elevation of the hand, by expansion of the walls of the cyst. A swelling not aneurismal, on the contrary, may be elevated at each stroke of the vessel, as well as have its apparent impulse augmented by increase of pressure ; but it has no expansion of its entire bulk at every point ; it is simply raised—and, whether in systole or diastole, its dimensions are unaltered. There is one exceptional case, however, which may render diagnosis very difficult. If a chronic ab-

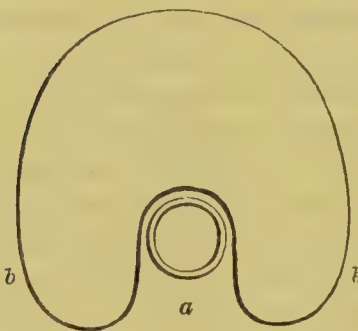


Fig. 172.

cess, or other cyst, overlay an artery thus—then its pulsation will be equal in all directions, each impulse will be accompanied with a sensation of expansion, and bruit may doubtless be distinct. Extrication from error, however, may still be within our power, by reference to the fourth test ; inasmuch as inquiry into the swelling's history will inform us, that when small and recent it shewed no sign at all aneurismal. This shuts out the idea of

idiopathic aneurism in such a case ; but at the same time it is to be remembered that the abscess, by encroachment on the vessel, may have ultimately perforated its walls, and so have been converted into a form of accidental aneurism, as formerly explained.

6. An aneurism ordinarily affords both thrill and bruit to touch and auscultation ; and the latter, in the larger arteries, may be double, like the impulse. Another tumour may possess the bruit, but has not both conjoined ; unless, indeed, it be the exceptional case just stated.

7. Pressure on the cardiac aspect of the aneurism diminishes its pulsation, bulk, and thrill ; pressure on the distal aspect has a precisely contrary effect. Another tumour may have its apparent pulsation similarly affected ; but the pulsation only.

8. Change of relative position affects the aneurism but little. Pull it rudely aside, and, by impeding arterial flow, the pulsation, expansion,

Fig. 172. Section of an abscess, or other cyst (b), overlaying an artery (a). The aneurismal state must be closely simulated under such circumstances.

and bruit may be diminished ; but, though diminished, they are still there. Do the same to another tumour, and pulsation is gone quite.

9. Perhaps the tissues are lax enough to permit our tracing the vessel's course with the fingers. If the tumour be aneurismal, it will be impossible to detach it from the artery ; if non-aneurismal, the vessel will be found at all parts perfectly free. Even at the supposed neck of the aneurism, perhaps, the finger's point may be inserted between the tumour and arterial tube.

10. In aneurism of the extremities, the limb beneath the tumour is shrunk, wasted, pained ; perhaps oedematous. And these appearances are not so marked, if they exist at all, in the case of a tumour which merely simulates aneurism.

Causes of Aneurism.

The disease is more frequent in men than in women ; and seldom occurs before the period of puberty. In the lower animals it is not common, except in the ass, in which animal it is connected with the presence of an entozoon—the *strongylus armatus*. These animals lie within the aneurismal sac ; their tails being entangled in the fibrinous clots, while their heads are free, and exposed to the current of blood.

1. *Predisposing causes.*—For the formation of idiopathic aneurism, as has already been stated, the existence of atheromatous degeneration of the arterial coats is essential. The most frequent site of such degeneration, and consequently of aneurism, is at the turnings of the blood's current ; whether by the natural curves of the vessel, as at the arch of the aorta ; or by the giving off of large branches, collaterally, or in bifurcation. At this point in the vessel the arrangement of the fibres of the middle coat is such as to leave a Λ shaped portion in the axilla of the vessel, with the fibrous textures much thinner than in any other portion of its walls. The period of life most favourable for the morbid change, as already stated, is between the ages of thirty and fifty. By previous degeneration the elasticity and tone of the vessel are greatly impaired at the part changed. At each impulse from the heart, the coats yield before the wave of blood ; but, wanting resilience, they fail to recover themselves as before. And thus dilatation is established and increased ; the dilatation in form and extent probably proportioned to the extent of arterial degeneration. The dilatation may proceed ; itself forming an aneurism. Or the internal and middle coats give way ; and then aneurism more rapidly advances, in the manner already detailed. When aneurism has been formed by dilatation only, communication between the cyst and artery is of course wide and free ; often of the same extent as the cyst itself. When it has resulted from giving way of the coats, the aperture is of more limited dimensions ; usually of circular form, sometimes no larger than a quill ; with margins well defined, smooth, and often of great density.

Senile earthy degeneration may also induce aneurism ; but does so much less frequently than the atheromatous. The change, it is probable, occurs in the following way. Where the earthy formation is greatest, a narrowing of the arterial canal is occasioned. On the cardiac aspect of this constriction, dilatation occurs. This may itself prove aneurismal. Or, as is more likely, the coats at this part yield either by laceration or by ulceration ; and then the aneurismal formation proceeds in the ordinary way.

2. *Exciting causes.*—The more prominent of these are violent muscular exertion, and mental emotion ; either of which, but more especially the former, may directly cause the giving way of the coats.

Certain occupations favour the disease. Those persons, for example, who are exposed to intemperance by their vocation, as well as compelled to undergo heavy labour which often demands sudden and great exertion, are daily under the operation of both predisposing and exciting causes. And, again, if the elderly and not too temperate patient be by his calling exposed to sudden stretching of a vessel, after prolonged relaxation of it—even without hard labour, or great muscular effort, occasional or habitual—aneurismal formation is likely to occur. For instance, the postilion, or any one similarly circumstanced, who has for hours his popliteal artery much relaxed in a bent position of the limb, may by sudden stretching of the member, on resumption of the erect posture, cause partial rupture of the coats ; and if arterial degeneration be present, as is not unlikely, aneurism certainly supervenes.

In some cases, atheromatous and calcareous degeneration pervades the whole arterial system ; and tendency to aneurismal formation is in consequence universal. Patients so affected are said to labour under the *Aneurismal Diathesis* ; prone not only to aneurism, but to aneurisms ; the tumours, in such cases, seldom proving single but gregarious. The existence of such a state is indicated by a peculiar thrilling jar of the pulse, as well as a wiry hardness of the vessels, and an obvious cachectic state of the patient. It contra-indicates operative surgical interference with a main trunk communicating with an aneurism ; however favourably adapted the tumour might otherwise seem for operation.

Cure.

Towards this end, as already stated, there occur :—deposit of concentric fibrinous layers, with agglutination to the cyst ; reaction of the superimposed and surrounding parts on the solidified tumour ; compression, thereby, of both tumour and artery ; probably obstruction of the latter by extension of the coagulum. Absorption of the solidified tumour gradually advances ; ultimately all traces of the aneurism have almost or wholly disappeared ; and the artery is either permanently obstructed, and obliterated, at that point ; or—as more rarely happens—it remains free and pervious.

The cure may be either Spontaneous or Surgical.

1. *The Spontaneous.*—The changes formerly described, as affecting spontaneous cure, may be induced by various circumstances. 1. *By pressure on the cardiac side of the tumour.* The artery may be here compressed by the aneurism itself, it having enlarged chiefly in that direction, and being bound down on the vessel by fibrous investments. The arterial flow to and into the cyst is consequently moderated, and the occurrence of solidification favoured. Or similar pressure, with similar effects, may be exerted, not by the original tumour, but by the formation of another aneurism in the cardiac proximity—an example of the cure of one disease by the establishment of another. Thus, for example, a subclavian aneurism has been cured by the pressure of a nascent

tumour formed on the *arteria anonyma*. But perhaps, indeed, it were an error to apply the term cure to such an event. A more favourable result is the third variety of pressure ; when a tumour, not aneurismal, and unconnected with the vessel—perhaps an enlarged gland—compresses the artery, or artery and aneurism both, so as to induce agglutinated coagulation in the cyst. The principal disease is cured ; and the secondary formation, the independent tumour, may either disappear spontaneously, or be dealt with afterwards if necessary.

2. *By occlusion of the aperture of communication* ; independently of pressure, or moderation of the arterial flow. A firm portion of coagulum becomes detached from the fibrinous mass occupying the interior of the cyst, and is impacted in the aperture ; either preventing, or greatly limiting the arterial influx, and obviously favouring contraction and solidification of the tumour. To this result it is plain that a smallness of communicating aperture is favourable ; and were we at all times able, by auscultatory and other signs, to ascertain the dimensions of the aperture, we might more truly predicate, in those cases of internal tumours which are inaccessible to surgical interference, the result of treatment with the view of obtaining spontaneous cure.

3. *By sloughing of the cyst* ; not partial, but including the whole. Inflammatory sloughing of the aneurismal cyst may occur spontaneously, or be the result of external injury. If the slough include the whole cyst, and spread no further, a fortunate issue may be predicated. The dead part separates in the usual way ; but not until the surrounding living textures have become densely occupied by plastic product ; and not until all the implicated blood-vessels, including the artery at the aneurismal part, have been consolidated. As the slough separates, consequently, no hemorrhage ensues ; and healing advances in the ordinary way. Profusion of purulent formation is the principal danger ; when the suppurated part is large, and the patient already low in system. Hectic may ensue. If the slough be but partial, however, and do not involve the whole cyst, there is the greatest hazard. On separation of the slough, the open cyst and artery will be exposed ; hemorrhage will be great, and probably fatal.

4. *By the aneurism becoming diffuse*. As formerly observed, if suppuration or gangrene do not occur, the pressure of the diffusely infiltrated blood on the cardiac portion of the artery may so restrain its flow as greatly to favour the occurrence of spontaneous cure.

5. *By obliteration of the artery on the distal aspect*. The aneurism, by making especial pressure there, may in truth effect a result similar to that of Brasdor's operation. The vessel may be gradually and finally shut up ; and if no collateral branch intervene between the occluded part and the opening into the aneurismal cyst, cure will follow. Or this occlusion of the artery may be caused by impaction of a fibrinous mass detached from the aneurismal clot—embolism : at first a mechanical obstruction, and perilous to the life of the limb, but ultimately producing safe and complete obliteration of the tube at that point, followed by either obliteration of the aneurism by concentric fibrinous laminae, or suppuration of the sac and evacuation of its contents.

2. *The Surgical Treatment*.—Spontaneous cure, by any mode, being comparatively of rare occurrence, is not to be trusted to in practice, when other means are in our power. In olden times, the surgeon did not hesitate

to interfere directly and boldly. In the time of Celsus the tumour was opened by the knife ; and to restrain the frightful hemorrhage, a heated cautery was thrust into the wound. Or, as practised by Rufus and Antyllus, the aneurism was cut into and cleared out, the vessel having been previously secured by ligature above and below the aneurismal part. After introduction of the tourniquet by Morel in 1674, the procedure became somewhat less formidable ; hemorrhage being restrained by pressure above until the artery had been secured, at least temporarily. Or, as was the case even so late as the days of Mr. Pott, finding these direct modes of operation very disastrous in their result, as might well have been anticipated, it was not unfrequently deemed expedient at once to amputate the limb above the aneurism—rather than encounter certainty of hemorrhage after deligation, and probability of bleeding along with certainty of exhausting suppuration after the cautery. But as the nature and treatment of disease became better understood, this department of practical surgery improved. About the middle of the eighteenth century, the operations for aneurism became less coarse in themselves, and more happy in their results. In 1740, Anel—doubtless having become aware that, for the establishment of cure, it is not essential that the sanguineous flow should be entirely arrested in the part—cut down above a traumatic aneurism at the bend of the arm, and, securing the artery immediately above the tumour, without opening the sac, effected a cure. It is to be remembered, however, that this was an example of accidental aneurism ; and that consequently the arterial coats, where tied, were not necessarily in a degenerated state, as they must ever be, more or less, in the immediate vicinity of aneurism which is idiopathic. For our illustrious countryman John Hunter was reserved the merit of really improving the operation. He reasoning further on the fact, that complete arrest of the flow is not essential to cure, saw how this enabled him to seek a comparatively healthy portion of the vessel on which to apply the ligature ; one capable of plastic change, and not prone to ulceration. He saw that it was not imperatively incumbent on him to tie the artery immediately above an idiopathic aneurism, where its coats may be expected to be specially diseased ; but that it was in his power to select a portion higher up—removed, perhaps, to the extent of several inches. Of this power of selection he did not fail to avail himself ; and in 1785, in a case of popliteal aneurism, instead of securing the artery in the ham, he tied the femoral near the middle of its course. Although the practice proved at first unsuccessful—the mode of operation, not the rationale, being defective—the soundness of the Hunterian theory stood unshaken ; and the subsequent experience of others, with operations better executed, obtained for it ample confirmation.

The original want of practical success resulted from the faulty mode in which the ligature was used. There existed in the profession an excessive dread of injury to the arterial coats, by a small ligature tightly applied. It was feared that they would be cut through too soon, ere yet the canal had been consolidated ; and that the most serious hemorrhage would ensue. Accordingly, broad tapes were tied on ; and others were applied loosely, in reserve, to be tightened as circumstances might demand. In an over-anxiety to save the arterial issue, it was unduly de-

tached and manipulated, so as to interfere with its vitality, and thus cause either ulceration or sloughing; and thence the much-dreaded hemorrhage; the means adopted to prevent this result turning out the most likely to insure its occurrence.

Success depends mainly on a skilful use of the ligature; and too much caution cannot be used in its application. The vessel is exposed by careful dissection, somewhere on the cardiac side of the aneurism; not so close as to endanger the encountering a suspected maximum of atheromatous degeneration; not so far removed as to favour too free a collateral supply of blood still remaining to the tumour. The external wound should be rather too large than too small; facility and safety of performance being closely allied in this operation. The incisions are made with a small finely-edged scalpel, used lightly. Neither directors nor blunt knives should be employed; for they must bruise and tear to a certain extent; and the simpler and smoother the cut is, the greater is the probability that both wound and artery will assume a salutary condition. The vessel having been exposed, its sheath—pinched up, if need be, by dissecting forceps—is opened to the extent of about half an inch; and by repeated touches of the knife's point, assisted by forceps, the arterial coats—looking at last white by the insulation—are completely detached from all neighbouring tissues; only however to a very limited extent; not more than what is barely sufficient for the passage of the needle and ligature. The aneurism-needle should have its point neither too sharp, to endanger wounding of the arterial coats; nor too blunt, to render tearing and force necessary for its passage. Armed with a firm, round ligature, of silk or thread—well waxed, to facilitate application—it is gently insinuated beneath the artery at the detached point; great care being taken to exclude all textures, save the arterial, from within its circuit; more especially nerves and veins. Having passed, the ligature is laid hold of, and retained, while the needle is withdrawn. The loop of the ligature is then cut, and one half pulled gently away. The remaining portion is secured on the vessel with a reef knot; drawn with such tightness as affords to the operator's fingers the peculiar sensation of the internal and middle coats having given way. One end is cut off close to the knot; the other is left pendant. The wound is then brought carefully together by suture and adhesive plaster—leaving the protruding end of the ligature readily amenable to both sight and touch—and is treated so as to promote adhesion. The limb is placed in a relaxed and comfortable position, and so retained.

In the case of deep-seated vessels, the more complicated needles of Weiss, Trant, etc., may be found useful; but in the majority of cases, the ordinary instrument, with ordinary skill, suffices.

The ligature is not interfered with until the usual period for its separation has elapsed; from ten to twenty or thirty days, according to the size of the vessel. Then its free extremity may be gently touched. If found loose, it is carefully withdrawn; if still adherent, no pulling is employed; we await patiently spontaneous loosening; and regard it as our duty to interfere and take away, only when the natural process of detachment has been completed.

By some it has been considered preferable to employ two ligatures,

dividing the artery between ; a modification in the deligation of arteries as old as *Ætius*, and strenuously advocated by *Abernethy*. Various points may be stated in favour of this mode of operation. The artery retracts freely, and thereby thickens its parietes, while it contracts its calibre ; the ligature is brought into close contact with healthy structures ; and consequently there may be less chance of suppuration, ulceration, and hemorrhage. Besides, it has been thought important—especially in the case of the carotid—to avoid the double impulse which a single ligature has to sustain ; the one direct from the heart ; the other dependent on the collateral circulation. Most certainly, if the ordinary operation have been improperly conducted ; that is, if in our attempts to expose the vessel cleanly, it have been detached too extensively from its surrounding connections—thereby rendering the occurrence of either ulceration or sloughing more than probable—let two ligatures be applied ; one at each extremity of the separated portion. The main objection to dividing the artery, is the risk incurred in such a procedure of wounding the accompanying vein or veins, or other textures of importance.

The effects of the ligature, well applied, are as follows :—There is mechanical arrest of the arterial flow at the deligated point ; throwing a stress on the collateral circulation ; and, by weakening the main current, on the distal aspect of the ligature, favouring fibrinous deposit within the aneurismal sac from the circulating blood, with gradual solidification of the tumour. The internal and middle coats of the artery should be at once cut cleanly through, as with a knife. They resile on each side of the ligature, and the noose of this embraces and puckers together only the external coat. The cut surfaces of the inner coat are kept in close contact ; and, being cleanly incised, in close apposition, and free from compression by the ligature, they unite by adhesion. Plastic product takes place for this purpose—furnished mainly, it is probable, by the connective tissue of the external coat—extending to a little distance on each aspect of the ligature ; and by it, becoming fully organized, the arterial canal at that part is permanently and firmly closed. And this salutary process is facilitated by means of a coagulum, which commences to form almost immediately after the application of the ligature. On the cardiac aspect of the ligature the blood is at once thrown into a condition of comparative stillness, favourable for coagulation, which sometimes extends up to the nearest collateral branch ; and the result usually is, the production of a slim and tapering clot—its base resting on the arterial tissue at the deligated point, its apex loose, and extending upwards a longer or shorter distance—non-adherent, in the first instance, to the coats of the vessel. This—slender though in most cases it is—will doubtless have the effect of removing the blood's impulse from the site of the new product, and so will facilitate completion of the process of occlusion. Whence it is obvious how anatomical knowledge may often be of service, in directing selection of the site of deligation, to a point where no collateral branch is given off in the immediate and cardiac vicinity. Otherwise, there might be, instead of remora, an increased tumult of circulation at the part which is undergoing the process of obstruction.

Plastic change is not limited to within the vessel. It occurs, and more extensively, on its exterior ; forming a dense swelling of some size,

within which the ligature's noose is deeply imbedded. The highly important, and even essential character of this external formation of plastic material, is fully elucidated by the experiments of Mr. Spence ; from whose unpublished drawings the accompanying illustrations are derived. He has shewn clearly that the internal clot, so far from being, as was



Fig. 173.



Fig. 174.



Fig. 175.

supposed by Manec and others, essential to the separation of the ligature without hemorrhage, is not unfrequently wanting when the vessel has been successfully tied ; the closure being entirely effected in these cases by the plastic product between the cut edges of the internal coats, and by the bulky fibrinous mass which forms by cell proliferation within and around the sheath. It is this external new formation which, becoming organized, forms the medium whereby blood is supplied from all the

Fig. 173. Carotid of a dog ; 48 hours after deligation. Recent effects of ligature. At *a*, the arterial coats cut across. Plastic change begun around ; and a clot on either aspect of the deligated part.

Fig. 174. Carotid of a dog ; 6 days after deligation. Artery cut across. The contracted ends occupied by coagulum. In the sheath, pinned out, external vessels (*a*) are seen coursing onwards to occupy the interior.

Fig. 175. Carotid of a dog ; 96 hours after deligation. Further advanced. The ligature seen imbedded in a large mass of organized plasma.

surrounding parts to the important new formations within the external coat of the occluded vessel ; and which, by its equable pressure upon the divided ends of the internal coats, prevents the tender adhesions within the sheath from being broken up, when the ligature separates, even when there is no coagulum. And hence arises an important practical caution ;



Fig. 176.

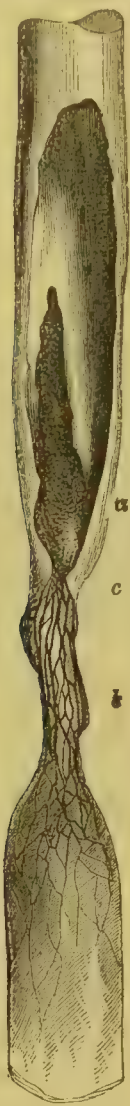


Fig. 177.

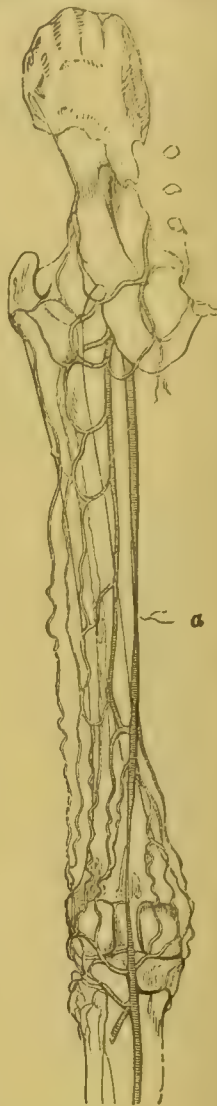


Fig. 178.

that it is not only advisable, in ligature of an artery, to avoid unnecessary separation of the vessel from its sheath, but also that every undue interference with the soft parts around is also greatly to be deprecated. According to Mr. Spence, the vessels of the new plastic material are formed with great rapidity. In one instance, in the dog, he found them present in considerable numbers sixty hours after the operation. After a longer time, vessels begin to pass even into the clot when this is pre-

Fig. 176. Carotid of a dog ; 13th day after deligation. The ligature detached, and coming away in the groove formed in the organized plasma.

Fig. 177. Carotid of a dog ; 12th day after deligation. Vascularization of the clot, by vessels from without. At *a*, the artery cut open, shewing the clot ; at *b*, the external vessels, coursing onwards, enter the clot at *c*.

Fig. 178. Collateral circulation shewn in the thigh. At *a*, the femoral artery has been obliterated by ligature.

sent ; these vessels being always in connection with those of the sheath and external product, and not proceeding, as has been supposed, from the interior of the artery.*

A very minute portion of the external coat included in the noose of the ligature has its vitality so impaired, by mechanical injury, that it separates. Molecular disintegration effects this in the ordinary way ; by ulceration. This destructive process extends no further on either side of the ligature, than what is sufficient for detachment of the noose of thread, with the particles of arterial tissue. And no accident by bleeding occurs ; for two reasons ;—First, on account of the very limited extent of ulceration ; second, because by the time it occurs the arterial tube has been, at that part, and some way beyond it, completely consolidated.

Thus the ligature, and the molecular particles of the external coat embraced by its noose, are detached from the living texture. There may be a slight obstacle to extrusion, from the external plastic formation—threatening to confine the noose ; but a slight touch of the free end of the ligature suffices to counteract this. On the ligature's final extrusion, the hiatus, so occasioned, is quickly filled up by fresh plastic product ; and all is made firm and sure. A dense compact swelling, of some size, thus comes to occupy the place of the arterial tube, at the deligated point.

Such copious plastic consolidation was essential, as has been seen, to prevent accident by hemorrhage during ulcerative separation of the ligature. But now that this event has been safely achieved, and the source of irritation gone, the new material is found gradually to diminish by absorption, and at length almost entirely to disappear ; the existence of any salutary adventitious growth usually ceasing with its usefulness. Ultimately, so far from there being a swelling or induration at the deligated point, that portion of the artery is found dwindled down to a mere fibrous cord, and the normal texture of the surrounding tissues is almost wholly restored. Above and below the obliterated portion, the vessel's calibre gradually tapers till the nearest collateral branch is reached ; and there the normal dimensions are usually suddenly restored. The internal coagulum shrivels, and ultimately disappears, by absorption.

Thus it is plain that the main object in conducting the operation and subsequent treatment is, in truth, the maintenance of a low grade of the inflammatory process ; the attainment of sufficient plastic change, and the averting of suppuration and ulceration—except what barely suffices for separation of the ligature.

Such are the effects of ligature on the artery itself, when well applied on a sound portion. And the chief advantage of the Hunterian mode of operation is, that it enables us to select the site of operation with a view to dealing with a portion which is expected to be comparatively sound. The effects on the tumour are, instant arrest of the pulsation and bruit, subsidence as well as silence of the swelling, and gradual induration of it by consolidation of the contents. This chain of favourable events is the result of the main current having been abruptly turned aside into collateral channels. And it may happen that the process of cure, thus begun, proceeds rapidly to completion without even a sem-

* The first part of Mr. Spence's researches may be found in the *Monthly Journal*, May 1843. The second is unpublished.

blance of interruption. But sometimes it is otherwise. Collateral circulation which had existed previously to the aneurismal formation, becomes more full and free immediately thereafter ; and after deligation of the main artery it undergoes necessarily a further enlargement, by the increased strain that is suddenly thrown upon it. At first the temperature of the limb falls ; in consequence of the direct arterial influx being suddenly impeded. But subsequently, it rises even higher than the previous standard ; the circulation having resumed its wonted copiousness, and the superficial vessels, especially, being more plentifully supplied. Some of these, scarcely appreciable before, may be both seen and felt pulsating vigorously. Sometimes, however, the temperature again falls beneath the standard of health.

In consequence of re-establishment of the limb's circulation, pulsation usually returns for a time in the tumour ; blood having freely come again by the circuitous route into the cyst, as well as into the main vessel on the distal aspect of the ligature. The ligature never wholly arrested sanguineous flow there, even for a moment ; collateral circulation is at all times too free to admit of this. It was only moderated ; and this moderation, conjoined with removal of the heart's impulse, was sufficient to originate the process of solidification, and temporarily to withdraw pulsation from the tumour. Complete arrest of the flow is not essential to cure ; nor indeed is it desirable. We do not desiderate an empty condition of the aneurismal cyst, but that it should be filled by solid contents. And, to afford a pabulum for fibrinous solidification, a certain amount of circulation is essential ; slow and dull, to favour coagulation ; and without energy of impulse, so as to maintain no distending or expansive effect on the cyst.

Along with return of pulsation, there may occur pain and heat, with other evidences of inflammatory accession in the tumour. So much the better ; so long as they do not prove excessive, and threaten suppuration ; for it is by such change in the cyst that the deposit of and the agglutination to the solid contents of the aneurism is most quickly and securely effected. Ordinarily all tenderness subsides in a day or two ; rendering the part quite tolerant of gentle pressure. And it may sometimes be expedient to have recourse to this, cautiously, when the return-pulsation threatens to continue beyond what is desirable. In applying such pressure the bandage is begun at the lower part of the limb, and no part is left unsupported.

Such is the modern operation for aneurism, with the effects which are expected to issue from it ; when properly conducted. But there is a preparatory and a subsequent treatment, of much importance ; neither of which can with safety be neglected. A patient is not to be taken from his ordinary avocations, and at once subjected to the ligature. For some days he should be kept in a state of repose ; his bowels and general secretions should be attended to ; his diet should be restricted, and all stimulant fluids absolutely prohibited. If there be a fulness of the circulation, or any apparent tendency to the inflammatory process, a moderate bleeding may be practised, or aconite or antimony given. After operation, complete quietude of both body and mind is maintained, and every other means taken likely to ensure a gentle and moderate state

of the general circulation ; this being obviously favourable to advancement of the process of cure. And about the usual time of the ligature's coming away, all moral and physical causes likely to accelerate circulation suddenly and much should be especially avoided. Regimen is strictly antiphlogistic. The limb is placed and retained in a relaxed and comfortable posture. No severe pressure is applied to the tumour, under any circumstances, lest suppuration or gangrene be induced ; and no pressure in any degree need be employed, unless pulsation return in excess, as already stated ; or unless, at a later period, diminution of the tumour become slow and unsatisfactory. Nor should manipulation of the tumour be frequently and roughly practised ; otherwise suppuration of the cyst is not unlikely. It is no doubt essential to watch the condition of the swelling ; and it is satisfactory to know that pulsation is absent, that solidification continues complete, and that diminution advances favourably ; but such knowledge can be readily enough obtained without much handling. All needless gratification of mere curiosity should be rigidly abstained from by the surgeon, and strictly prohibited on the part of others.

Stimulant frictions, or more direct applications of heat, may perhaps be thought of immediately after the operation ; the temperature of the limb having fallen considerably below the normal standard. There can be no worse practice. At this time, vital power in the limb is very low ; and if the stimulation induce any considerable amount of vascular disturbance, as is most likely, gangrene is almost sure to follow. Either let the limb alone altogether, or swathe it gently in a layer of fine cotton wadding. The temperature, as already stated, is best regulated under nature's spontaneous effort ; and vital power, along with circulation, is gradually restored.

After deligation of the large arteries near the trunk of the body, free venesection, perhaps repeated, may be advisable ; with a view to save the important organs within the great cavities, from the evil effects of sanguineous determination caused by sudden interruption of the main current. After ligature of the common carotid, for example, the lungs are in danger by congestion, which may induce an apoplectic state of that tissue, or pass on into pneumonia ; casualties, tending to a fatal result, which can in such circumstances best be obviated by loss of blood.*

At one time it was a question as to what period of the case was most favourable for operation ; and in general it was held that some considerable delay was advisable, in order to permit the collateral circulation to have become fully established. But it is now well understood, and generally admitted, that so soon as there is aneurism there is sufficiency of collateral circulation ; more likely to prove excessive, and cause trouble and anxiety by undue return of pulsation—than to be deficient, and induce gangrene directly by failure of arterial supply. Gangrene is certainly one of the dangers of the operation ; but in the majority of cases in which it has occurred, it has probably been not the direct but the indirect consequence ; not by insufficiency of arterial supply, but by induction of inflammatory mischief ; not by the fault of the operation, but by that of the attendants in the subsequent treatment.

* London and Edinburgh Monthly Journal, January 1842, p. 1.

The limb has been rubbed, heated, or otherwise stimulated, prematurely and to excess.

But cure may fail, even should the deligation itself succeed. Success is not invariable. 1. There may be an idiosyncrasy of system, whereby coagulation of the blood is prevented; a diathesis analogous to the scorbutic, or to that which is termed hemorrhagic. In such circumstances, the remedies tending to oppose that state are to be employed; acetate of lead and opium, sulphate of soda, etc. 2. Or there may be a want of re-active pressure and support on the solidifying tumour, by superimposed textures. As has been well shewn by Mr. Porter, aneurism of the upper part of the carotid is unfavourably situated in this respect. From a want of investing texture on the pharyngeal aspect, the tumour not only extends chiefly in that direction, during growth; but also, after operation, it may fail to solidify, contract, and disappear. Other aneurisms, when superficial, may labour under similar disadvantage. Such deficiency is to be atoned for, as far as circumstances will permit, through application of artificial pressure and support, by means of compress and bandaging.

The casualties which may attend on the operation by ligature are hemorrhage, phlebitis, and gangrene and suppuration of the sac. The most important of these is hemorrhage.

This may be variously induced. 1. By sloughing of the arterial tissue. The artery has been too freely and extensively detached from its surrounding connections; it loses both its mechanical support, and, from imperfect nutrition, its vital power. A certain amount of the inflammatory process necessarily follows the injury done in operation; there is no sufficiency of power in the inflaming part to resist or control; it perishes; and, on separation of the slough, a gush of arterial blood discloses the open condition of the artery. Thus is occasioned the earliest form of bleeding; occurring within a few days after the operation. A large space of vessel being usually opened, the flow may prove at once fatal. More frequently, however, it remits; and by repetition exhausts the patient.

2. By ulceration at the time of the ligature's separation; usually between the tenth and twentieth days. How this may occur has already been explained; from want of plastic product, on the one hand; and from proneness to ulceration on the other. It may be the fault of the artery; the coats at the deligated point being so degenerated as to be quite incapable of the required salutary change. It may be the fault of the operation; the coats having been too much detached; not enough to induce sloughing; but quite enough to carry the inflammatory process beyond the plastic stage into that of suppuration and ulceration. It may be the fault of the ligature; too broad and clumsy in its nature; not dividing the internal coat, so as to permit resilience and coaptation of the cut surfaces, favourable for adhesion; and, by necessarily producing a large slough, so disturbing the vitality of the adjoining as well as of the included tissue as to induce a proportionally great amount of ulceration during the process of detachment. Or it may be the result of accidental circumstances, over which we have little or no control; as erysipelas, purulent infiltration, phagedænic ulceration, febrile disorder,

etc. Practically, it is important to observe, that in this form of bleeding the flow is, in the great majority of cases, from the distal side of the ligature. There, doubtless, the vital powers of the tissue are more depressed than on the opposite aspect; for the immediate effect of tightening the ligature will plainly be, to interfere with both nervous and vascular supply in that part of the arterial tissue. On both sides, ulceration must ensue; to detach the noose and included external coat. And on that side where power is least, the morbid process will be most rapid and extensive; while surrounding plastic change is most defective. On the distal side, the coats are likely to ulcerate more rapidly and widely than on the cardiac; and while on the latter aspect the tube is shut, at and beyond the line of ulceration, on the former it may be open and ready to bleed.

3. Or hemorrhage may be altogether independent of the ligature's separation; occurring either before or after that event; more frequently after. Abscess forms in the tissues around; it enlarges, and includes the vessel; plastic change is interrupted; by pressure of the abscess ulceration is effected in the arterial coats, from without; and the pervious canal is opened—it may be above or below the ligature, according to circumstances. Were the practice followed, as advocated by some, of cutting off both ends of the ligature after its application, and were the wound to adhere completely in its external part by adhesion—it is plain that this casualty would be rendered very probable. The noose would act as a foreign substance; after, as well as during and before its separation from the living arterial issue. It would become the cause and centre of an acute abscess. That abscess, cooped up and confined by closure of the external wound, would by extension implicate the vessel more and more, and too probably at length effect an ulcerated aperture into a pervious portion. By this time the external wound has again opened; or it may have been but partially shut; and the hemorrhage is free.

Secondary bleeding by ulceration is often preceded by marked febrile accession—a circumstance of no little interest to the practitioner, as forewarning him of the coming danger; sometimes enabling him to avert it altogether; in all cases preparing him to meet the emergency. Secretion is arrested, the pulse becomes full and throbbing; the head is pained, the face flushed. The patient is restless, anxious and alarmed; and complains of a tightness about the chest. Then comes the hemorrhage. “When unexcited he lies pale and exsanguine, yet at the same time excessively irritable and anxious; but whilst under the influence of the febrile paroxysm, his face is flushed, his skin hot and dry, his pulse tight and bounding, but affording a peculiar sensation resembling a double beat; and it is during a period of such exacerbation that each successive hemorrhage occurs.”* Such fever is seldom absent when hemorrhage has taken place, and continues by repetition. But the first occurrence is sometimes preceded by no febrile state whatever: the flow coming without any warning; perhaps seeming to be induced by some movement of the patient, in changing posture, in coughing, in straining while defecating, etc.

The bleeding may spontaneously cease. More frequently, however—and sometimes even when active and suitable treatment has been em-

* Porter.

ployed—it recurs once and again. And the patient may die exhausted ; partly from the direct effects of loss of blood ; partly from the disorder of system which the exsanguine state has induced.

Treatment.—In the first instance let it be prophylactic. The preliminary febrile paroxysm is marked and met. Bleeding from the arm may be practised, if not otherwise contra-indicated ; of such an amount, and so taken, as to produce a decidedly sedative effect on the heart's action, and on the general circulation. And this effect is maintained, by subsequent exhibition of a full opiate. Thereafter, aconite, or veratrum may be advantageously used ; to prolong the beneficial result. By thus calming the tumult of circulation, at the suspected point as well as elsewhere, an additional opportunity may be afforded for occlusion by suitable plastic change ; ulceration having ceased. Or if bleeding do occur, it will be in a comparatively moderate and diminished flow.

When the dreaded casualty has taken place, treatment varies according to the nature of the cause. 1. If it be according to the first, we need have no hesitation in tying the vessel afresh, at a bleeding point ; using two ligatures—one on the distal and one on the cardiac side of the open space.

2. In the second form of secondary hemorrhage, if we are certain that the bleeding comes from the distal aspect of the ligature, as in most cases it does, little benefit need be expected from an additional ligature on the cardiac aspect ; and this procedure, therefore, is not adopted in the first instance. The wound is cleared of coagulum, and enlarged if necessary, so as to expose completely the bleeding point ; and this is overlaid by a graduated compress, retained so as to exert that degree of pressure which seems to be expedient ; the rest of the limb being duly supported by bandaging. As a general rule, it may be stated that the pressure, if exact, need not and ought not to be severe. Exactness, combined with moderate intensity, will be sufficient to arrest the flow, and to induce a plastic product sufficient to fill the chasm. A higher force would not be more effectual as a hemostatic, and would probably cause renewal of ulceration or sloughing in the compressed arterial issue ; occasioning repetition of the casualty by renewal of its cause. In many cases such pressure will succeed ; when conjoined with general treatment suitable for maintaining gentleness and tranquillity of circulation. Should it fail ; then, as a last resource, let a fresh ligature be placed on the cardiac aspect, by a fresh wound ; while pressure is maintained as before. The second ligature may succeed in stanching the flow ; but, in its turn, it may prove the cause of a second bleeding, by recurrence of ulceration at the newly deligated part. Let there be no despair, and inactivity in consequence. So long as space permits, let ligature follow ligature on the cardiac aspect ; and it is quite possible that in the end success will still be ours. Examples of such perseverance in surgery, well rewarded, are not unfrequent.*

3. In the third form of secondary hemorrhage, let the abscess be speedily evacuated. Then if there be reason to suppose that the artery at that point will hold the ligature, let the double ligature be used there, after suitable dissection. If otherwise, place a ligature on the cardiac

* Amongst others the following :—London and Edinburgh Monthly Journal, vol. i. p. 336. *Ibid.* vol. iii. p. 109.

side higher up ; and maintain direct and moderate pressure over the bleeding point. If second deligation be impracticable—as too often is the case, this form being most frequent in the deep-seated vessels, as those at the root of the neck—pressure must be trusted to alone, along with general treatment.

4. Where the condition of the tumour, of the limb, and of the patient, as well as the occurrence of secondary hemorrhage, concur in rendering the prospect of our efforts to save both patient and limb, to say the least, improbable, then amputation of the limb, at or a little above the point of deligation, should be resorted to without further delay.

Another casualty, scarcely less alarming, may follow deligation ; inflammatory seizure of the concomitant vein. If the phlebitis be of the worst kind—diffusely suppurative—this of itself at once perils existence. And, supposing only the simplest form to occur—that which terminates in thickening of the coats, and occlusion of the canal at the point affected—gangrene is rendered probable ; pervading the whole limb, and demanding amputation. In fact, according to some, gangrene, after deligation of the femoral artery, never comes on except where the femoral vein has been injured in the performance of the operation. This danger should ever be borne in mind when conducting the operation. The vein should be studiously avoided, and left undisturbed—by forceps, fingers, knife, and ligature. As already stated, it is of much importance, as regards the artery itself, that its tissue alone should be included in the ligature's noose. And as regards the success of the operation, it is not less important that the surrounding tissues should be uninjured ; and of these most especially the vein. Phlebitis, once excited, under such circumstances, will scarcely be within our control, so as to avert the evil consequences. It is well to remember, however, that although the limb may for a time seem gangrenous and threaten to die, the actual sloughing or sphacelation may be very limited. In such circumstances, then, it is usually well to let nature determine how much is to recover ere we proceed to amputate.

Suppuration of the aneurismal sac sometimes occurs after the application of a ligature upon the cardiac aspect of the tumour ; but seldom until the vessel at the aneurismal part has become obliterated. The symptoms are sometimes severe, and may even be alarming. When satisfied that suppuration has occurred, a free incision should be made into the sac ; when pus, clots, and broken up fibrinous laminæ will escape, leaving behind the gaping thickened walls of the sac. These will in course of time contract—helped by the employment of stimulating lotions and pressure. In some cases, however, hemorrhage ensues ; and in such circumstances amputation will usually be the only suitable treatment.

It may happen that, some days after the operation, both patient and practitioner are alarmed by the sudden occurrence of strong pulsation in the wound ; not connected with the state of either the artery or the aneurism, but entirely muscular ; intermittent, and not synchronous with the arterial pulse. Alarm on such ground is unnecessary. In a short time, some simple antispasmodic having perhaps been given, and quietude maintained, the normal state is restored.

Other methods of treatment, which have been and still are in use, now claim our attention.

The old operation, by direct incision, has been recently revived by Mr. Syme, and with a certain amount of success ; incising the sac, turning out the contents, and tying the artery above and below the aneurismal opening, as in the case of accidental aneurism. The soundness of such practice seems to depend upon the settlement of this question—Are the coats of the vessel necessarily in their maximum amount of atheromatous degeneration at that point, or are they quite as likely to be as sound there as at the point of Hunterian selection ? Evidence as to this grave matter is now desired, through pathological research and observation. Should it prove favourable, then such a method of operation would certainly be preferred in certain localities ; in axillary aneurism, for example, tying the affected vessel in preference to even the outer third of the subclavian.

The operation of Brasdor is the reverse of that of Hunter ; the application of a ligature, not on the cardiac, but on the distal side of the tumour—in its near proximity. This method of applying the ligature, first suggested by Desault, was recommended in his lectures on theoretical grounds by Brasdor, and performed for the first time in a case of aneurism of the common femoral by Deschamps. Obstruction occurs at the point tied ; coagulation and remora of the arterial contents take place up to the nearest collateral branch ; and, if there be no vessel given off between the tumour and the point of deligation, the former will obviously be included within the range of delayed and coagulating blood—a state favourable for originating and advancing the process of cure. If, however, any branch of considerable size do interfere, it is equally plain that the effect of deligation may be to cause an increased turmoil at and within the tumour, and to aggravate the disease accordingly. Also much difficulty may be experienced in cutting down upon the vessel. It may have been already obliterated ; it may be much displaced from its normal relative position ; in the great majority of cases, as formerly stated, it is certain to be somewhat diminished in size ; the surrounding parts may have been the seat of a chronic form and low grade of the inflammatory process, and the vessel may be intimately blended with condensed and infiltrated structure.

This mode of operation, then, applied generally to aneurism, is obviously inferior to the Hunterian. Yet its employment has occasionally been deemed expedient. In an aneurism situated so close to the trunk of the body as to preclude the application of ligature on its cardiac side—instead of abandoning all surgical interference, and resorting merely to medical treatment in the hope of facilitating the accession of spontaneous cure, thus, as it were, leaving the patient to his fate—some have even recently urged the propriety of resorting to the distal operation, if circumstances seem otherwise favourable ; and if the patient, after having heard an honest explanation of the risk, express himself willing and anxious that the attempt should be made. In aneurism, for example, of the common carotid at its origin, where experience has amply proved that we need not attempt the Hunterian operation, by ligature of the anonyma—that being certain to fail—Brasdor's operation, they say, is not unlikely to succeed ; inasmuch as there is a long space of the carotid from which no branch is normally given off, and consequently no vessel is likely to intervene between the tumour and the distal ligature. The

practical experience of its employment does not however hold out any great encouragement to the operator ; a fatal or an unsatisfactory issue having in all cases, hitherto, followed its performance. In 27 cases 20 died within a short time of the operation ; and the remaining seven escaped only with their lives.

A modification of Brasdor's operation is usually associated with the name of *Wardrop* ; a mode of treatment not very promising of success, but rather seeming to contain within itself the elements of failure. Supposing aneurism to exist in an arterial trunk, on the cardiac aspect of its bifurcation, it is proposed to tie one of the branches only ; and from that interference, combined with the partial obstruction of the other branch which the disease is presumed (from pathological inquiry) to have produced, to hope for a favourable result. According to this system, for example, in aneurism of the arterial anonyma, it would be held sufficient to tie either the subclavian (thrice performed, by Wardrop, Dupuytren, Langier) or the common carotid (eight times, by Evans, Mott, Key, Fergusson, Morrison, Campbell, Hutton, Evans). Here, however, there is a manifest certainty of a collateral branch, and that of very great size, intervening between the tumour and the ligature ; a circumstance, as already seen, hostile to success.* Both carotid and subclavian have been tied either simultaneously or in succession, with the view of effecting a more thorough interference with the circulation through the aneurism, but, as might have been anticipated, with an equally unsatisfactory result. Mr.

Wardrop's operation, or a modification of it, has been performed fourteen times in all. Of these cases twelve died ; one is said to have been retarded ; and one is supposed to have been cured.

Temporary ligatures have been proposed ; and trial, sufficient to establish their inexpediency, has been made by Travers, Dalrymple, etc. Temporary application is unequal to effect, with any certainty, the changes external and internal to the canal at the deligated point ; and the disturbance and injury done to the vessel, however short the time of application, are quite as likely to induce ulceration and hemorrhage, as if the deligation had been permanent ; perhaps more so, inasmuch as, besides mechanical interference in the application of the noose, there is added that which is necessary to effect its removal.

* Let the reader, however, judge for himself, by considering Mr. Wardrop's own statement in the *Cyclopædia of Practical Surgery*, vol. i. pp. 226-239.



Fig. 179.

Fig. 180.

Fig. 181.

Thick and flat ligatures were at one time used, to meet the false dread of premature division of the vessel's coats ; an event of which experience has shewn there is no danger, if the tissue be in a tolerably sound condition. Draw a firm round ligature as tightly as you may, the inner and middle coats alone yield ; the external remains entire. A greater risk is that which comes by ulceration or sloughing of the arterial coats, opening into a yet patent canal ; plastic change being either absent or imperfect. And such risk is greatly enhanced by flat tapes ; their application not only entailing extensive separation of the arterial tissue from its surrounding connections, but also rendering it certain that a considerable portion must slough and separate, and that consequently no slight amount of suppuration and ulceration—the main danger—shall be inevitable ere the foreign substance can be detached. Although the high name of Scarpa was attached to such practice, it need excite no wonder that it has fallen into complete desuetude ; as also the plan of interposing compresses, of various kinds, between the artery and ligature.

Similar objections exist to exposure of the vessel by incision, and then, instead of deligation, applying graduated pressure directly to the tissue, by means of Dubois' *serre-nœud*, or Assalini's compressor. The practice had no success, and is obsolete.

It has been proposed to extend the principle of subcutaneous puncture to the deligation of arteries ; passing the needle round the vessel without any preliminary incision. By such a mode of procedure there is obviously no safety for artery, nerve, or vein.

Ligatures made of animal substance, as catgut, have been used, and both ends cut away ; in hope of the noose becoming absorbed. Others of a metallic nature have been similarly employed, with expectation that they would become encysted and quietly resident ; as bullets and other metallic substances not unfrequently do, when lodged in the ordinary tissues. Both forms of ligature, however, have hitherto been regarded by Nature as foreign substances, and, sooner or later, have been extruded by suppuration accordingly. Metallic ligatures, of fine silver or iron wire, easily flexible, may be well employed, however, in the same way as those of silk or thread ; tying the vessel in a firm knot, cutting off one end, leaving the other hanging from the wound, and waiting its extrusion by the usual process of detachment. The irritation of such ligature being usually less than that occasioned by those of thread or silk, we may expect the risk of excessive ulceration to be proportionally diminished.

Treatment by pressure.

In ancient times, the surgeon, when afraid to cut into an aneurism, and take his chance of arresting the flow of blood, had recourse to direct and energetic compression of the part, with the hope of cure. The name of Guattani is chiefly associated with the practice. Local sloughing, suppuration, or ulceration, with severe constitutional disturbance, and with an unclosed artery and aneurism, proved the most frequent result. Subsequently to the establishment of the Hunterian operation, however, its principle has been extended to the mode of treatment by pressure, this being applied, not to the tumour itself, nor in its immediate vicinity.

but at some distance ; at a part such as would be selected for Hunterian deligation, in the hope of the arterial tissue there being in a comparatively sound condition.

In two ways art may promote the cure of aneurism ; by retarding the aneurismal flow, and so favouring consolidation of the contents ; or by aiding the textures which overlay the aneurism, and which are, as it were, continually striving to keep it down and repress its growth. The one method diminishes the expansive power from within ; the other increases the repressive power from without. The latter corresponds to the old method of applying pressure ; the former to the modern.

This method was made trial of in the beginning of the century by Pelletan, Dubois, A. Cooper, Blizard, etc. ; but with no satisfactory issue. The pressure was continued and severe ; their object being to keep the arterial tube close and impervious at that point, and by plastic change to obtain its complete consolidation. The result was, the occurrence of great pain and constitutional disturbance, followed by ulceration, or sloughing of the compressed parts—exposing, or perhaps including, the vessel. The practice found no favour with the general profession. But twenty years ago the treatment by pressure was revived by Mr. Hutton

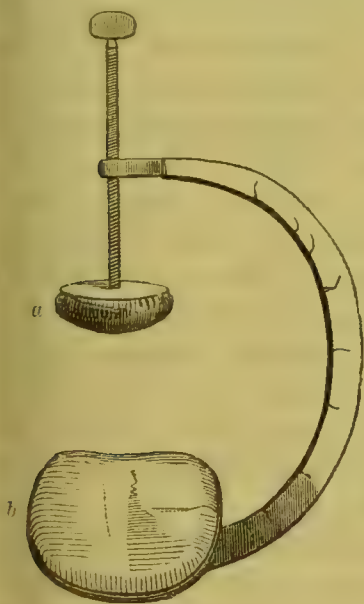


Fig. 182.

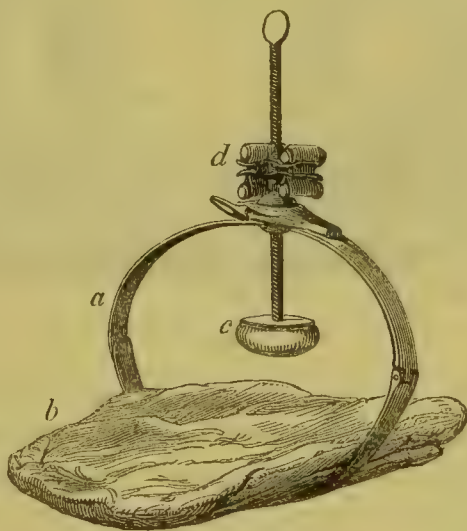


Fig. 183.

and Dr. Bellingham of Dublin, in a modified form, and with a better success ; conducted rather as if itself were not the agent of cure, but only the means whereby spontaneous cure may be originated and favoured. The pressure, besides being made at a Hunterian site, is neither constant nor severe. By means of a compressor, such as invented by Signoroni (Fig. 91, p. 217)—or by means of this other instrument, adapted from a carpenter's clamp, and first suggested by a carpenter, Hoey, who was himself the subject of aneurism, and cured by this means—a moderate

Fig. 182. The clamp, as at one time used in Dublin ; *b*, the point of counter-pressure ; *a*, that which compresses the artery.

Fig. 183. Dr. Carte's instrument for compressing the femoral at its lower part ; *a*, the metallic girth over the thigh ; *b*, the pad for counter-pressure on the back part of the limb ; *c*, the compressor ; *d*, the elastic arrangement.

degree of pressure is applied to the vessel ; at a point where its coats may be expected to be sound, and consequently not prone to resent such pressure untowardly. This is maintained, so long as it can be conveniently borne by the patient ; but no longer. So soon as uneasy sensations become at all intense, with perhaps swelling and numbness of the limb, and throbbing in the part, pressure is either slackened or altogether removed. Afterwards, the parts having recovered, it is reapplied ; again it is removed ; and thus, by occasional and modified use, the disasters formerly attendant on treatment by compression may be altogether avoided. At the same time, circulation in and near the aneurism is de-

cidely moderated, so as to favour solidification. The tumour is not only arrested in its growth, but begins to diminish ; its pulsation is less, and its dimensions contract ; some day, perhaps, it seems to enlarge, beats louder, and grows tender to the touch—this is the *cystitis* so favourable to agglutination, and a hopeful sign ; soon the tumour quiets down again, feels harder, and is less compressible ; ultimately, the pulsation wholly disappears, and induration is complete ; absorption then ad-

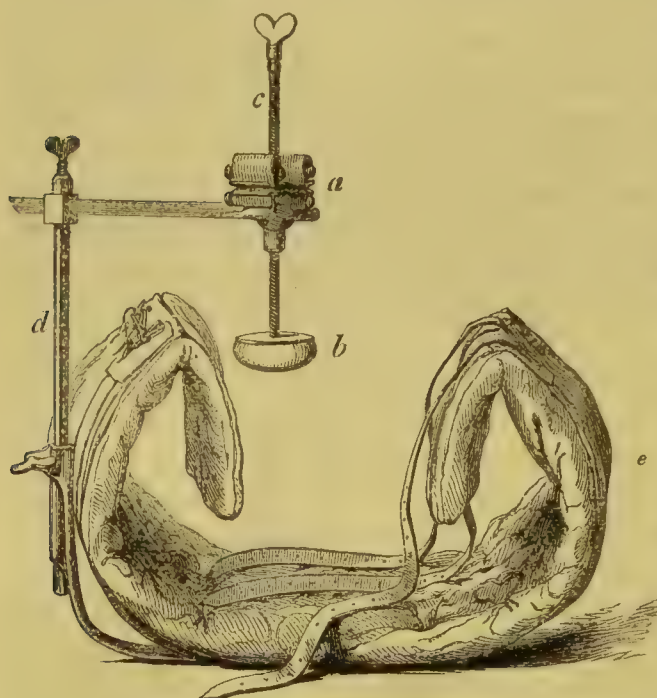


Fig. 184.

advances, and the oblitative cure is obtained, with or without a pervious condition of the vessel at the aneurismal point.

Instead of employing a single instrument, and so confining the pressure to one point, it is better to use two or more compressors—when circumstances will admit of this, as in the case of the femoral artery. One is slackened, the other screwed tight ; alternately. And thus the pressure, being as it were diffused more widely, is more easily borne. Further, it is well also to diffuse the counter-pressure, by placing a splint of leather or pasteboard between the skin and pad of the instrument ; the former being first covered with soap plaster.

Or the more elegant and efficient apparatus of Dr. Carte is employed ; the advantages of which are the accuracy of the pressure, and the elasticity of the compressor. The artery is sufficiently operated on ; while at the same time the part is comparatively absolved from irritation. Or the same indications may be still better fulfilled by a modification of Signo-

Fig. 184. Dr. Carte's instrument for compressing the femoral at its upper part ; *c*, the girth for encircling the pelvis ; *d*, iron rod rising out of it ; *e*, the working screw, with the compressor at its end ; *b*, the compressor ; *a*, the elastic apparatus, engendering tolerance of the pressure.

ronis' compressor, in which the elastic element is introduced, according to the plan of my pupil Mr. Brims.

But even these instruments are not to be looked upon as perfect. No doubt they are doomed to give place, and that perhaps ere long, to some plan yet more simple. And probably that will be the use of *animal pressure*; the fingers and thumbs of steady assistants being employed, who are got in sufficient numbers to maintain not only an absolutely constant, but a sufficiently continuous pressure on the vessel, with that accuracy and elasticity which the intelligent and living organism alone can supply. Sometimes but a few hours of such pressure suffices to initiate the process of cure. When, however, such relays of assistants cannot be obtained, the method more recently employed in Dublin and elsewhere may be satisfactorily adopted. This consists in applying a leaden weight varying from four to eight and a half pounds over the course of the femoral artery; and according to Mr. Cusack seven and a half pounds is the average weight required to command the circulation through this vessel. The weight may be kept in its place either by means of a strap loosely encircling the limb, or by means of a leather or pasteboard tube, which is retained by straps, and is of size sufficient to contain and support loosely the leaden weight, which should be of an oval form. By some, again, the weight is perforated and allowed to slide loosely upon the rod of the Carte's apparatus, its ordinary compressing pad having been removed.

But pressure is not trusted to alone. Some preparatory treatment is necessary, as before the operation by ligature. And, throughout the whole period of treatment, absolute repose with recumbency is maintained; as well as antiphlogistic regimen, the administration of opiates, and all other means likely to favour the desired beneficial change. Also, it may be well that the limb below the compressed point should be uniformly and equably supported by bandaging, lest congestion and œdema supervene; and this support may from time to time be cautiously extended to that part of the limb which includes the aneurismal tumour. Or such direct pressure, added to the indirect, may be accomplished in another and better way (as recommended by Messrs. Ernest Hart and Shaw); viz., by change of position in the limb; flexing the leg upon the thigh, for example, in the case of popliteal aneurism; and increasing or lessening the degree of the flexion and pressure, as circumstances may seem to require, by a band which attaches the heel to a waistbelt.

Let no haste be indulged in. The process is ordinarily gradual, not sudden; interrupted, not continuously progressive. The pressure requires to be neither great nor constant; for we do not desire obstruction, even temporary, of the arterial tube there; it is sufficient to moderate, not essential to arrest the flow. And only by a constant remembrance that such are the principles of cure by this means, will the treatment be so leisurely and prudently conducted, as to ensure avoidance of the disasters to which compression is otherwise liable.

The contemplated advantage of such a mode of treatment, when properly conducted, is the sense of absolute safety in the means employed, even if abortive; subsequent recourse to the ligature, if need

be, being not precluded. Should pressure fail, deligation is at least as likely to prove successful as if no previous treatment had been employed; unless indeed its long continuance shall have so increased the collateral circulation, that it has acquired a capacity sufficient to maintain the aneurismal condition even after deligation has been practised. And this is no mere theoretical objection; for before these days of compression, such cases did now and then occur after the use of the ligature, the aneurismal symptoms diminishing for a time and again becoming as characteristic as ever when the circulation and pulse in the extremity became restored. The disadvantages are, therefore, a protracted period of treatment, sometimes a considerable amount of pain, ultimate uncertainty of cure, and the possibility of its interfering with an after resort to ligature. If improperly conducted, compression is in every point of view certainly inferior to ligature well and properly employed; not only less certain of cure, but also even more certain of danger at the selected part of the vessel. And it need cause no surprise that unfortunate cases have occurred. But, when well managed and employed with due selection, pressure bids fair to supersede ligature, in many cases of external aneurism; more especially the popliteal.

The leading points of the method may be again stated. The pressure is at some distance from the tumour; moderate, and regulated according to the feelings of the patient. It is not necessary, and it is not our object, to obstruct, far less to obliterate the vessel at the compressed point. In other respects the same treatment is followed out, regarding both part and system, as in favouring spontaneous cure without any surgical interference.

The first successful case of the modern use of pressure occurred in the practice of the late Mr. Todd of Dublin, in 1825. But the method then fell again into disuse; until once more revived, in 1842, under more favourable auspices, by Dr. Hutton of the same city. Mr. Cusack, Sir P. Crampton, Dr. Bellingham, and others, followed; also with success. Mr. Liston and the rest of the London School in due time became converts to the practice. And now ourselves have, for some time, been following in the wake; while statistics from all quarters are bearing out not only the safety but the success of the practice.

In 127 cases of popliteal aneurism treated by compression according to the analysis of Broca, 116 were successful, and six died; while of 188 cases recorded by Morris, in which ligature of the femoral was performed for the same condition, forty-six died, and in six which recovered amputation had to be resorted to.

But to take a more special experience of these two methods of treatment, Dr. Bellingham states that in thirty-two cases of popliteal aneurism in which compression was employed, twenty-six were cured; and of the remaining six, two died, in two amputation was performed, in one the ligature was resorted to, and in one all treatment was discontinued. In Mr. Syme's experience, while he has tied the femoral thirty-six times for popliteal aneurism, he has had a satisfactory result in every case. And the statistics of Mr. Busk and of Dr. Toogood, although more limited, has been equally satisfactory in favour of the ligature.

In tying an aneurismal artery, no skill in the operation can altogether avert risk.—Of phlebitis ; for the vein usually is in close apposition with the artery, and must be exposed to the risk of injury.—Of gangrene ; for impression on the limb's circulation is inevitably both great and sudden.—Of hemorrhage, above all ; for the artery tied may be at the point of deligation more or less altered in structure, and consequently liable to the unfavourable results of the consequent inflammatory change. Pressure, unskilfully and rashly applied, is at least equally capable of causing these risks. But pressure, employed according to the principles now enjoined, in its modern revival, escapes them all. Let it be tried, therefore, in all cases suited to its use ; with such care in the using, in regard to both method and time, as shall, in the event of failure, leave no obstacle or drawback to the subsequent employment of ligature.

Other methods of Cure.

Cold has been applied continuously to the tumour ; in the hope that contraction of the cyst and solidification of its contents might be thus favoured. The contemplated advantages, however, are not obtained ; and danger by sloughing is probable.

The insertion of a *seton* has been tried ; and there is no need to repeat the experiment. The certainty of danger is not compensated by the probable advantage.

The application of galvanism, by acupuncture, has produced good results in certain cases. This method of cure was first proposed by Mr. B. Phillips in 1832. Afterwards, it has been successfully prosecuted by MM. Petrequin, Ciniselli, Abeille, and others. The object is to produce at once both coagulation of the aneurismal contents, and plastic disturbance in the sac. The galvanism is passed through the tumour by means of needles, which are partly covered with a layer of gum-lac varnish, in order to protect the ordinary tissues which they have to traverse. The needles having been lodged in the tumour, and retardation of the aneurismal circulation having been effected by temporary pressure above, the galvanic current is set on, of such strength as the patient is able to bear ; anæsthesia being employed or not, as circumstances may seem to require. "To succeed in coagulating the blood, it is necessary to introduce the needles at opposite points, so that they may correspond with each other—to place them in an oblique or perpendicular direction to that of the blood, in order to oppose a barrier to its course—to cross them, in order to render their influence more active—and to multiply them in large aneurisms, so that a certain number of clots may be early produced, sufficient to act as a frame-work for the whole coagulum. It is also advantageous to change the direction of the currents many times, so that the galvanic fluid may act in every way, so as to produce a multitude of filaments that will extend as a meshwork through the sanguineous mass. In difficult cases it is necessary to continue the galvanic action a long time, better to insure success, even repeating the electric applications at successive sittings."*

* British and Foreign Review, No. xlviii. p. 419 ; Monthly Journal, Aug. 1846, p. 150 ; *Ibid.* Nov. 1846, p. 374 ; *Ibid.* Jan. 1848, p. 521 ; *Ibid.* May 1848, Retro-spect, p. 89.

Patients who are intolerant of pressure, and hostile to knife and ligature, have by this means some prospect of obtaining cure of aneurism. Watchfulness is necessary, however, lest an excess of effect be induced, and suppuration or even gangrene threaten. M. Bonnet states that in twenty-three cases treated in this way, thirteen failed, and in nine a successful result was obtained. In seven of these, however, other methods of treatment, such as cold and compression, were likewise employed.

Injectations into the sac have been made trial of, as of tannin, solution of the per-chloride of iron, etc., with a similar object in view ; as yet, however, with something considerably less than a successful issue.

Manipulation of the aneurism has been proposed, in tumours inaccessible to the ligature and unsuited for indirect pressure. The object is twofold : 1, by breaking up the clot to lodge a portion, perhaps, in the arterial aperture, and so to favour coagulation of the aneurismal contents ; 2, by exciting the aneurismal cyst, to induce the plastic process needful for agglutination. The risk is parallel : 1, lest fibrinous clots be forced into the arterial circulation, and produce embolism ; 2, lest the cyst be ruptured, and the diffuse form of aneurism supervene—or lest the cyst, remaining entire, assume an excessive amount of the inflammatory process, running on to disastrous results. Obviously the method needs much caution in the using.

Amputation—not unfrequently resorted to in this disease by the old surgeons—is still preferable to all other modes of treatment under certain circumstances. 1. Should bone have been hopelessly involved, during progress of the tumour. 2. When the diffuse form of aneurism has occurred to a great extent ; so that absorption and consolidation cannot remedy the evil, and great as well as extensive suppuration must occur in the infiltrated tissues. Even supposing the aperture in the vessel to have been closed, such suppuration, and the hectic following, would be certain ultimately to demand amputation. And should the arterial aperture remain open, danger to life by hemorrhage would occur at an earlier period ; with the first evacuation of purulent fluid. 3. When disease of the vein co-exists ; impeding venous return. If by pressure or deligation, in such a case, we at the same time impede arterial influx—although only imperfectly, or for a time—it will be difficult to avert the occurrence of gangrene, as a direct and almost immediate result. Amputation would then be demanded, on account of spreading gangrene ; under circumstances which afford but slender hope of success. It were better to amputate at once, and anticipate the evil. 4. When a large aneurismal sac has suppurated, in a patient already weak. Suppuration of the entire cyst is one of the modes of spontaneous cure ; and when surface is of no great extent, secretion not profuse, and the frame robust, the cavity usually fills up and consolidates. But if the surface be large, secretion great, and the system already worn, hectic is almost certain to occur ; of so formidable a nature as to demand sacrifice of the limb, in order to save life. 5. When from any cause gangrene threatens ; of the limb ; not of the tumour only—for this latter, as formerly explained, may prove the means of a spontaneous cure. 6. It has been proposed as a modification of Brasdor's operation, in cases of axillary aneurism involving so much of the subclavian as to prevent the performance of the Hunterian operation, that amputation at the shoulder-joint, beyond

the aneurism, should be performed. This, although obviously a forlorn hope, is not so absurd in principle as ligature of the vessel beyond the aneurism most assuredly would be ; for it not only arrests the circulation through the main trunk upon which the aneurism is situated, but also through all the branches given off between the cardiac aspect of the tumour and the point of amputation.

Treatment of Aneurism beyond the reach of Surgery.

Not unfrequently, aneurism is so situated as to be amenable to none of the ordinary methods of treatment. In such cases the issue is likely to prove untoward ; the disease continuing to advance, till death ensue by one or other of the methods formerly noticed. Yet there may be some hope of spontaneous cure. And, further, we have some means in our power whereby that event may be favoured. Our object is to oppose the tumour's increase, and favour its becoming consolidated and impervious. The obvious mode of accomplishing such an end, is to moderate circulation in general ; at the same time promoting coagulation in the part. It is not advisable to take blood ; but aconite, or belladonna, or the veratrum viride, will be useful in maintaining a sedative effect on the circulation ; the dose being, of course, regulated by the effect produced. Food is simple, nutritious, and non-stimulant ; simple, so as not to excite the circulation ; but not too meagre, otherwise a thinness of blood will result, unfavourable to the occurrence of fibrinous deposit, and consequently hostile to not the least important indication of cure. A due proportion of fibrin is essential ; and nicety of management is plainly necessary to secure this, yet maintaining gentleness of arterial flow. Regulation of the bowels is not to be neglected ; but all drastic purging should be abstained from. For, though at first a sedative effect may be thus obtained, excitement of the circulation is almost sure to follow. Repose of both body and mind is carefully enjoined. The nature and object of the treatment are explained to the patient, and his intelligent yet not over-anxious co-operation is thus secured. By long, patient, and skilful perseverance, he may be rewarded by a cure ; but, unfortunately, even under the best management, this is rather the exception than the rule.

Treatment of Accidental Aneurism.

Probably the most common example of this læsion is the result of wound in venesection, at the bend of the arm ; and that may be taken as a sufficient illustration of the general subject.

Prevention of the aneurismal formation is in our power ; if the case be seen at the moment of injury, or even soon after. Firm pressure is made with the thumb over the puncture, while an assistant is busy encircling each finger of the wounded member separately in a bandage ; these bandages meet in the palm ; and a roller is then carried from the hand upwards, until the site of puncture is reached. A graduated compress of lint is placed accurately over the wound ; the compressing finger or thumb being cautiously removed for this purpose. And the compress is retained securely in its place by the roller ; bandaging being

made considerably tighter there, than on the rest of the limb. Energetic pressure, as well as accurate, is required, and the previous bandaging permits us to exert that with impunity: whereas, without uniform support of the whole limb, even moderate compression could not be borne safely for any length of time. Gangrene has ensued from the omission. The dressing is retained, in a state of firmness and efficiency, for several days; when it may be re-applied somewhat more slackly. But it should not be altogether discontinued for two or three weeks. Our object is to shut the arterial canal entirely, at the wounded part; both temporarily and permanently; first by mechanical apposition, afterwards by plastic change. And thus all aneurismal formation is manifestly frustrated. Pressure being accurate and effective from the first, there is no infiltration or accumulation of blood in the areolar tissue, and no condensation of that into a containing cyst.

No evil consequences are likely to follow such obliteration of the vessel at the injured part; and consequently it is a needless refinement in surgery, to attempt closure of the arterial wound only, by a more delicately conducted pressure. During such an attempt, it is more than likely that blood will escape from the puncture, and the aneurismal tumour will become duly established.

Should pressure fail, or should no opportunity have offered for its employment, the tumour certainly forms and demands a cure. This may be attempted, in the first instance, by flexing the forearm, so as to compress the tumour somewhat, and diminish the arterial supply; the latter indication being further promoted by pressure on the trunk of the humeral above, as in idiopathic aneurism. Should this fail, recourse is had to ligature at the injured part. A tourniquet, or the fingers of an assistant, having been applied to the humeral, to restrain hemorrhage temporarily, a free incision is made throughout the whole extent of the cyst; avoiding the superimposed vein. The coagulum is turned out, and the aperture of communication in the arterial coats looked for; if obscured, a slackening of pressure above gives a jet of blood, which will readily disclose the site. By means of the knife's point the artery is carefully detached from the surrounding parts—the venous tissue being especially avoided; and a ligature is passed, accurately, above and below the punctured point. A full-sized probe introduced into the aperture renders the arterial tube more distinct, and facilitates its isolation by dissection. If the cyst be large, dense, and compact, it may be dissected away, either in whole or in part; the wound being then more favourably disposed for healing, without much suppuration. Then pressure is removed. The wound is approximated; one end of each ligature protruding. And the treatment is conducted with a view to adhesion.

A variety of false aneurism sometimes occurs, termed *Varicose Aneurism*. The punctured aperture remains pervious in both vein and artery; the vein having been transfixed, and its superficial wound alone closing along with the integumental incision. The aneurismal cyst forms in the usual manner, but with a double communication; deeply, on the posterior aspect, with the artery; superficially, with the vein. In consequence, there is a mal-adjustment of the circulation at this part; arterial blood making good an entrance into the vein, whereby distention of the

latter occurs to a greater or less extent. The symptoms are the same as in the ordinary tumour ; with the addition of varicose enlargement of the vein, and unusual activity of circulation within it. A peculiar thrill and bruit are at the same time readily perceptible by the finger and ear ; compared by some to the noise of the fly-wheel of a musical box, by some to the purring of a cat, and by others to the buzzing of a fly confined in a



Fig. 185.

paper bag ; once observed, easily remembered. In other words, the aneurismal bruit is unusually distinct and palpable (*bruit de diable*).

Treatment is the same as for the ordinary form of traumatic aneurism. Sometimes it may be practicable to tie the artery above and below its aperture of communication, by lateral incision and dissection ; leaving the sac and dilated vein intact.

A similar condition may be the result of disease without any injury. Suppose an artery and vein in juxta-position ; as the abdominal aorta and vena cava. An aneurismal pouch begins to form in the artery, and extends in the direction of the vein ; the cyst becoming incorporated with the venous coats. Perforation occurs in both tissues ; and an aperture, more or less free, is established between the two vessels, entailing a constant and free commixture of their contents. Such a condition of parts, so situated, is plainly irremediable. Spontaneous cure, by occlusion of the aperture and consolidation of the cyst, is possible, but not probable. Usually the result is fatal ; by disorder of the general health, which the faulty circulation cannot fail to produce.

Aneurismal Varix is a second variety ; and may also occur at the bend of the arm. The artery and vein communicate, as in the former case ; but without any cyst interposed, the artery playing directly into the venous cavity. The swelling is less, but more diffused ; the circulation is



Fig. 186.

more plainly tumultuous ; thrill and bruit are more or less distinct, according to the size of the communicating aperture ; varicose distention of the vein is great. Painful sensations, with some interstitial swelling, attend on the first formation. But these subside gradually, and may at length almost wholly disappear ; the morbid state remaining



Fig. 187.

Fig. 185. Varicose aneurism. *a*, The artery ; *b*, the vein ; *c*, the intermediate cyst.—SIR C. BELL.

Fig. 186. Outline of varicose aneurism. Diagram.

Fig. 187. Outline of aneurismal Varix. Diagram.

in all respects stationary. The limb below the tumour is imperfectly supplied with arterial blood, a portion of the artery's contents entering the vein, and returning to the heart; the limb consequently is cold, numb, and vitally weak. By obstruction to the venous return, also, passive congestion and œdema are likely to ensue; at least for a time. By and by, collateral circulation having become fully established, both arterial and venous, a comparatively healthy condition may be largely restored.

In consequence of this comparative absence of inconvenience and growth, the case cannot be regarded as one demanding operative interference. Pressure is sufficient; to repress swelling, and to moderate, if not prevent, sanguineous intermixture. We have no hope of so occluding the aperture. Palliation is our only object; repressing growth, removing uneasy sensations, and permitting use of the limb. Should, however, a case occur of unusual urgency, and the patient become dissatisfied with merely palliative treatment, a direct incision may be made on the artery; and, a cautious dissection having separated its coats from the surrounding parts, above and below the aperture of communication, a ligature may be passed and secured at each of these points. The affection itself is rare; and still more so are examples of urgency sufficient to render such operative interference expedient.

ANEURISM BY ANASTOMOSIS; VASCULAR, OR ERECTILE TUMOUR.

This, having been classed with tumours, might have been considered along with them. Yet it comes naturally in connection with diseases of the arterial tissue. The term denotes a diseased formation in which the vascular tissue bears the most prominent part.

There are varieties of such adventitious structure. 1. The capillaries of a portion of integument may be equably and permanently dilated; producing discoloration, and but slight elevation of the affected part. Such enlargement and injection are to but a slight extent; and do not increase. Yet bleeding may be somewhat free when a breach is made in the surface, by ulcer, or by wound. This is one form of *nævus*, or congenital mark; an affection of no danger, and but little inconvenience. It may be looked upon as rather a deformity than a disease.

2. The structure may consist chiefly of dilated veins, retentive of tone and energy of function; fed by arterial branches, of somewhat corresponding size and activity; yet the latter tissue holding but a comparatively subordinate part in the development of the tumour. This morbid structure is not found in the substance of the true skin, like the preceding, but in the subjacent tissues; of various size and prominence; causing a doughy elastic swelling, of a livid hue—venous structure appearing with tolerable distinctness through the superimposed integument. If breach of surface take place, hemorrhage is profuse, and chiefly of the venous character; capable of being arrested by pressure, without much difficulty. If an incision pervade the mass to any considerable extent, arterial branches may be found spouting actively; but still the main stream is dark and venous.

3. The third form of swelling is composed of capillaries and minute arterial branches largely dilated, with the intervacular spaces encroached on or wholly obliterated, and the vascular walls thickened and strengthened thereby. These vascular tubes communicate freely with each other, and maintain a circulation of great activity; which is returned by a proportional amount of large and tortuous veins. Also radiating around are the feeding arteries; originally perhaps twigs, now enlarged to trunks; pulsating strongly, and obviously carrying on a plentiful supply. The mass may be subcutaneous; constituting the true "aneurism by anastomosis" or "erectile tumour;" varying in bulk and tension, according as the circulation is sluggish or excited; compressible; elastic to the touch, and indicating its tubular structure on being pinched or rubbed when in the flaccid state; of a reddish hue; in some parts tending to livor, but not continuously so, as in the preceding form of tumour. Or it may be submucous. The structure is analogous to normal erectile tissue; but with this difference, that whereas in the normal there are periods of complete repose and collapse, tension and fulness occurring but occasionally by local determination—in the morbid there is never utter flaccidity and repose. The tumour is more full and tense at one time than at another; yet at all times it is full and active; evincing an undulatory movement, if small; but when large, pulsating strongly and with bruit, as in ordinary aneurism.



Fig. 188.

Strictly speaking, there is no aneurism here; but rather a simple exaggeration of vascular tissue and function; no degeneration of coats, but dilatation with hypertrophy—and not this alone, but with corresponding increase of function as well. The morbid formation may supervene at any period of life; but most frequently it is congenital; and, growing faster than the normal structures around it, claims our attention at an early age. The most common situations are, beneath the integuments of the face, head, neck, back, and buttocks; not unfrequently it forms on the hands and feet. Sometimes it occurs within the orbit, and it has been met with in internal parts and organs, such as bones and the liver. The tumour pulsates synchronously with the heart's action; but much less distinctly, and with less expansion, than real aneurism. It may be considerably diminished by equable and sustained pressure; resuming its wonted bulk on removal of this. A bruit is heard; dull, and rough; and sometimes associated with a vibratory thrill. At first the skin is free; ultimately it becomes involved in the morbid structure, and incorporated with the general mass. Sometimes the growth is slow; sometimes, and more frequently, rapid. In all cases, bulk is temporarily increased by mental excitement, muscular exertion, and whatever suddenly and much excites the circulation.

According to some, most of such growths have their ultimum; attaining to a certain amount of development and then becoming stationary—or even retrograde. Superficial scalp and face formations some-

times evince such tendency, no doubt—especially in children during dentition ; but the majority of the active tumours elsewhere usually grow on. Having become superficial by involvement of the skin, ulceration is likely to occur ; and hemorrhage follows ; profuse, and not easily restrained ; demanding active interference, otherwise by repetition or continuance it may exhaust the patient. Or ulceration may have a salutary result. If surrounded and preceded by plastic change, the vascular structure may be consolidated ; no bleeding taking place, even from an acute and wide ulcer. And this consolidation advancing as the ulcer spreads, so as invariably to precede and surround the breach, the adventitious structure may be altogether got rid of ; partly by obliteration, partly by ulcerative loss of substance.

Sometimes hemorrhage is vicarious in the female adult ; taking the place of the menstrual discharge. The tumour becomes tense and full at the return of each period ; a small fissure, or sore, forms in the skin ; and from this the blood slowly distils. Such bleeding is seldom dangerous, or even excessive ; and is not to be suddenly arrested, without means having been duly taken to secure regularity of the normal discharge.

The tumour may also degenerate. That is, it may change its character, and become of a worse kind than at first. Medullary or amelanotic matter may be produced in and around it, or come altogether to take its place—the original character of the growth being entirely lost. This I have seen occur.

The erectile tumour being not a mere deformity, but a disease of importance, tending by growth and casualties to bring life into peril, the question of *Treatment* is not devoid of interest. It may be conducted on three different principles. 1. *By removal of the morbid structure.*—Excision, so applicable to tumours in general, is here inexpedient ; the extent and activity of the component vascular tissue rendering that mode of removal in the highest degree perilous. To cut into such a tumour, when large and pulsating, would be the height of rashness ; the gush of blood might prove almost instantly fatal. To cut even wide of the diseased texture, is not always a matter of safety. Unless the knife move cautiously, and forceps and ligature follow nimbly after, the loss of blood may still be dangerous. The mode of removal by excision, therefore, must be limited to those tumours which are small—not larger than a prune—of no unusual activity, not fed by large and numerous arterial trunks, so situated as to admit of the incisions being made wide of the diseased structure, and also in a locality favourable for use of the ordinary means of restraining hemorrhage. In all other cases ligature is preferable.

Supposing the skin to be involved, a needle in a fixed handle is passed beneath the mass, carrying a stout double ligature ; the needle is then withdrawn, and the ligature left. The noose having been cut, each portion is tied separately on either aspect, so as to include the whole of the morbid tissue ; pulling with as tight a strain as the ligature will bear, in order at once to kill the included part, and save both time and pain. If the swelling be circumscribed and prominent, this mode of deligation will be found very suitable. If diffuse, a second needle and ligature may be passed at right angles to the first, and managed in a similar way ; the tumour then being secured by four nooses

instead of two. Or, if too flat and spread for even this, two harelip pins may be passed beneath the base, at right angles to each other, and left there; each extremity of each needle protruding somewhat beyond the integument. Then a stout ligature is thrown around the whole mass, and drawn tightly beneath the protruding ends of the needles. In this way, the noose is made to embrace the whole of the diseased formation. Whichever method is adopted, it may be necessary, in the case of large tumours, to make a fresh application within a few days after the first, in order to expedite sphacelation. When the erectile tumour is of large size, especially when superficially elongated in form, the best procedure is to pass successive portions of a long stout ligature from side to side at intervals of an inch and a half or two inches. The first and last portions should be passed beyond the erectile structure. The different nooses, which the needle has carried through, having then been divided, we have an equivalent number of loops formed, including different portions of the structure; and by tying the corresponding ends of those loops successively, the whole disease is strangulated.

More complicated means of deligation may be practised. But in ordinary circumstances the simple methods now described will be found quite sufficient.

In all cases in which the integument is uninvolved, the use of knife may happily accompany that of the ligature; the former being employed, in the first place, to reflect the integument in flaps, and thus to expose the diseased structure naked and defenceless to the noose. In this way, strangulation being effected much more effectually, the part is killed at once, and soon sloughs off. The flaps are then reponed; and, in consequence, not only is the process of cure by granulation abbreviated, but loss of substance also is avoided, and the cicatrix is freed from puckering and deformity:—a point of some considerable importance, when it is remembered that the most ordinary sites of the tumour are on the head,

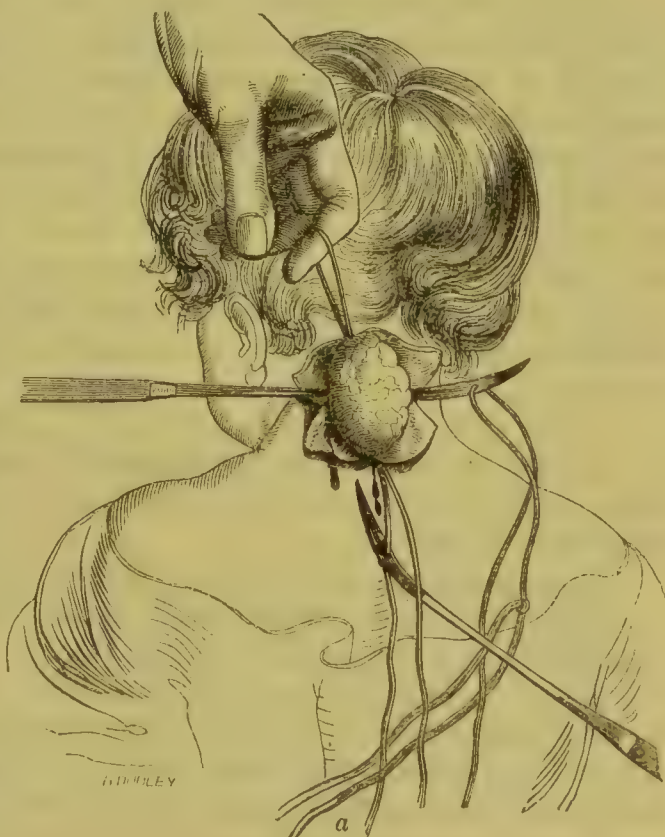


Fig. 189.

Fig. 189. Erectile tumour in a common situation. The integument, uninvolved, has been reflected by flaps. Transfixion is being completed, previous to deligation. *a*, A larger ligature, in the act of being pulled through. It fills the aperture of puncture, preventing bleeding; and besides, bears a stronger strain in the tying.

face, and neck. As the subcutaneous form is rarely met with, however, this modification is seldom applicable in practice.

Sometimes the morbid structure is so diffuse, as to render inclusion of the whole, by one deligation, impracticable. In that case, it may be taken away in detachments ; the operation being repeated at different parts, successively.

2. *By diminution of the arterial supply.*—When the tumour is so situated as to be inaccessible either by knife or ligature, this mode of treatment is advisable. When, for example, erectile tissue occupies the cavity of the orbit, we are warranted in performing deligation of the common carotid ; and experience has spoken in favour of the practice. Circulation is weakened in the tumour, not arrested ; and coagulation may occur, causing obliteration ; or it is possible that the dilated vessels may recover their normal calibre, and remain pervious. The salutary result is greatly favoured by free blood-letting, after the operation ; a practice in two points of view highly expedient ; first, because protective of internal organs from congestion, as formerly explained ; second, by maintaining a diminished circulation in the part, as well as in the whole system, favourable to the desired salutary change. At the same time, the other means, formerly spoken of as conducive to languor of circulation, will not be neglected.

When the arteries which feed a large tumour on any part of the general surface are numerous, deligation of the principal trunk at some distance is not likely to prove effectual. In such circumstances, it has been proposed to surround the tumour by incision, so as to cut off the vascular supply ; tying each vessel as it springs ; inducing flaccidity and collapse of the tumour ; and by continued pressure, afterwards, probably causing obliteration of the morbid tissue. Or, instead of deligation, the feeding arteries may be obliterated by the twisted suture ; as in varix. The practice has been adopted with partial success ; but in all situations where deligation of the tumour is available, this is much to be preferred.

3. *By effecting change of structure ;* consolidating the contents of the vessels, and obliterating their canals ; converting by plastic change the loose tubular texture into a dense and compact mass. This may be effected in various ways.

Pressure may be applied with sufficient intensity. In consequence, sloughing may occur ; but if this be preceded and accompanied by dense plastic change, no harm will result.

If the growth be small and superficial, a fine needle may be passed beneath, and a roll of ligature applied above, as in twisted suture ; the needle being withdrawn so soon as the inflammatory process seems to be sufficiently excited by compression. Formations capable of being so treated are sometimes found on the bridge of the nose ; especially in the female.

Potassa fusa may be applied. Not intensely, so as to produce a large eschar ; for, on its separation, there would be a risk of hemorrhage ; but lightly, so as to induce ulceration—imitating the form of spontaneous cure which sometimes occurs.

The galvanic cautery, a red-hot needle or awl, or one dipped in any

caustic, may be introduced, and moved in various directions through the mass. The inflammatory process follows, accompanied by more or less of the desired plastic change. The hot needle introduced frequently and freely, so as to traverse all parts of the tumour, is admirably suited to the minor cases so common in young children. The result is most successful; and the remaining mark by cicatrix is but slight, the skin being undestroyed.

Or, with a like view, some coagulating fluid may be injected through a puncture; by means of a fine syringe. This proceeding, however, must be conducted cautiously, lest diffuse suppuration occur, or sloughing, with grave constitutional symptoms; and such caution is specially needful in the case of patients of tender years. If the injection of a fluid capable of inducing rapid coagulation, such as the solution of the perchloride of iron, is used incautiously and in large quantity, the coagula formed in the tumour may pass into the right side of the heart, and thence into the pulmonary circulation, and induce all the evil effects of partial or complete embolism of the pulmonary arteries. Galvano-puncture has been employed successfully by Nelaton.

A seton may be passed through the tumour; the needle small; and the thread large, so as to occlude the aperture completely, and prevent immediate bleeding. It is worn till suppuration is fully established, with accompanying plastic change more or less copious; and, if need be, one or two such may be made to traverse the tumour in various directions. To increase their effect they may be soaked in alum, or in the solution of the perchloride of iron.

The part may be inoculated with croton oil; expecting obliterative inflammatory change to follow. Or nitric acid may be pricked into the tumour with a needle.

Vaccination may be performed on the part. A child having been born with such a growth, vaccine virus may be inserted beneath the skin at various points of the little tumour, instead of at the usual site in the arm. The likelihood is that the inflammatory process, which attends the formation of the vesicle, will have an obliterative effect on the morbid tissue. And this is a very advisable method of treatment when the tumour is of no great extent, and is seen in time. It requires watching, however, lest dangerous sloughing ensue.

At the same time, it is to be remembered that all such minor modes of treatment are liable to fail; rendering subsequent recourse to more stringent measures necessary. And it is prudent, therefore, to limit their use to the minor examples of the disease. Wherever probability of failure is at all considerable, it is better to have recourse at once to that remedy which is certainly infallible. The more especially as one mode of operation is usually as formidable in the eyes of the patient and friends as another.

4. *By amputation.*—If the diseased texture involve the greater part of a finger or toe, foot or hand, as sometimes happens, it is well at once to amputate the affected part; due arrangements having been made for the unusual amount of hemorrhage which is likely to occur.

The second form of vascular tumour, consisting chiefly of enlarged

and tortuous veins, is in general most conveniently treated by deligation. When small, and on an external part, however, it may be excised.

The first form of growth, or *nævus*, may be excised safely enough ; if the deformity be deemed a sufficient warrant for so severe a measure. In the majority of cases, it will be better to content ourselves with inducing ulceration. The potass, needle, and vaccination, will here be found suitable.

Not unfrequently, what seems to be but a *nævus* in the infant, grows into an erectile tumour during childhood or adolescence.

Another form of *nævus* consists merely of discoloration. Vesication may be tried ; by the nitrate of silver, or otherwise. But, in truth, the affection is so trivial as scarcely to call for interference.

Arterial Varix, or Cirroid Aneurism.

By this term is meant a dilated and tortuous condition of an artery, due to dilatation of its coats in fusiform pouches, including only a part of the circumference of the vessel ; the condition analogous to what is so common in veins. It chiefly occurs in superficial vessels of a minor class ; as the branches of the temporal, and the arteries of the fore-arm and hand. But it is comparatively rare. Relief may be obtained from gentle and uniform support, by bandaging. When the affection is limited



Fig. 190.

and troublesome, compression by ligature may be employed as in varicose veins. I thus destroyed an arterial varix, of some size and great activity, in the web between the thumb and fore-finger of an artist ; who attributed the origin of the swelling to pressure made by habitual wearing of the palette. Previously to deligation, I had made unsuccessful trial of acupuncture and galvanism, with a view to obtain consolidation of the arterial contents.

ARTERIAL OBSTRUCTION—EMBOLISM.

An artery, we have seen, may be obstructed by coagulation of its contents, with or without inflammatory change in its coats ; and the event may be serious or not, according to the extent and rapidity of such obstruction.

Fig. 190. Arterial varix of the arteries of the palm.

Sudden, painful, and complete obstruction, however, may occur in another way; namely, by the arrest of a clot of fibrin, which may have come from the heart, or been formed at a distant part of the arterial circulation. This condition is termed *Embolism*.

Acute pain is complained of in the part, sometimes shooting down the limb; pulsation is arrested beyond the point of obstruction; the limb becomes numb and cold; and, in short, the effects are very similar to those of arterial deligation. The pain continues, and spreads along the course of the vessel; the obstructed part, besides feeling tender, is perhaps somewhat swoln. The system sympathises; and sometimes seriously. The risk in the case of the arteries of the extremities is gangrene, unless healthy vessels, youth, and systemic vigour enable the parts to hold out till the collateral circulation has been fully established. In the vessels of the head and neck, the interference with the normal supply of blood to the corresponding part or side of the brain, induces depression of function, and, it may be, softening of the portion of cerebral substance so affected. The symptoms, in such circumstances, are frequently first apoplectic, accompanied with hemiplegia; this either continuing persistent, or followed by partial or complete recovery.

Treatment is mainly negative; abstaining rigidly from the employment of heat, stimulants, or friction to the limb. Opium internally is of much use, not only in assuaging pain, but also in contributing to maintenance of the circulation; but, of course, when the brain is the part affected, opiates must be withheld, unless the severity of the pain demands their use. In prolonged cases, when a limb remains swoln, hard, and powerless, some benefit may arise from the local use of mercury, applied without friction.

These observations apply to arteries of the aortic system. Those of the pulmonary are liable to similar lesion, the impacted plug coming from the right side of the heart, or having been carried through this from a vein. The symptoms are, from the first, most alarming and distressing; in most cases, where the extent of circulation interfered with is great, terminating fatally by asphyxia.

CHAPTER XVI.

AFFECTIONS OF VEINS.

PHLEBITIS.

By this term is understood the inflammatory process, in its various grades, occurring in venous tissue ; an affection much more common than arteritis. Chronic degeneration of the coats, on the other hand, so frequent in arteries, is in the veins comparatively rare.

Phlebitis may be either idiopathic or traumatic ; the result of injury, or unconnected with any assignable external cause. But a more important division is into the limited and diffuse, and into the obstructive and suppurative.

Coats and contents are altered by the morbid process. In the minor grades, the latter assume the solid form, and become incorporated with the coats ; which are thickened and rendered opaque, by plastic change. In the advanced grade, pus may be formed between the thickened coats ; constituting abscess there—limited to a spot, or stripping up the textures diffusely. Or, if it be granted that the inner coat has the power of furnishing purulent secretion, this fluid may accumulate within the venous tube, constituting what might be termed venous abscess, the canal being obstructed by consolidation above and below ; or it might mingle at once with the passing blood, the vein remaining pervious. This state of matters, however, which must not be mistaken for pyoid softening of a fibrinous clot within a vein, is in the present day doubted, and denied by many.

The ulcerative stage of the inflammatory process causes perforation, and hemorrhage if the tube be free ; a result not so common as in arterial tissue, and more frequently making its approach from without than from within.

The tendency of the inflammatory process when developed in the venous tissue to extend rapidly and far by continuity, is not easily explained. At one time it was supposed that, in consequence of this, the fatal issue of the more aggravated cases could be accounted for ; the affection having reached the right side of the heart, and arrested the all-important function of that organ. But experience has shewn that such is not the case. In the great majority of examples, the inflammatory process has stopped long before the heart has been reached ; the coagulum usually terminating abruptly, where a cross current flows in upon the main, through a collateral branch. The extent of femoral phlebitis, for example, is likely to be abruptly limited where the saphena joins ; while humeral phlebitis terminates where the cephalic enters.

I. OBSTRUCTIVE PHLEBITIS.—This is the minor grade of the process ;

giving no worse results than thickening of the coats and occlusion of the tube. There is pain in the affected part, increased by pressure ; and the vein is felt thickened and hard. The integuments are involved ; presenting a broad, red streak, immediately above the affected vein, and corresponding in extent. Sometimes simple erysipelas is co-existent ; and then the peculiar stripe becomes merged in the general redness. The system labours under a febrile accession ; slight, and of the inflammatory type. The venous contents coagulate ; the coats become thickened : and then the vessel feels a firm, hard, and painful cord. The limb—the lower limbs are the ordinary site of this form of the disease—beneath the affected part, is more or less swoln by congestion—the result of venous obstruction ; and the areolar tissue around the inflaming vein is also somewhat cedematous. On the inflammatory process subsiding, the cord begins to soften and decrease ; and then one of two events may occur. The coagulum may break down, and the debris passing into the general circulation, the tube may become pervious as before ; a thickening of the coats being the only remnant of the morbid results. Experience proves that a vein, hard and obviously impervious for weeks, may again open up its cavity, and carry blood as before—a common event after the treatment of varix with a view to the radical cure. Or obstruction may continue ; the coats and solid contents remaining completely incorporated, and both dwindling down by uniform absorption ; the vessel's tube is obliterated, and transformed into the semblance of a mere thread.

Ordinary antiphlogistics, moderately applied, suffice for the treatment of this form of the disease. Rest, fomentation by lead and opium, low diet, purging, aconite, or antimony. Leeches are not often demanded. When deemed necessary, they are applied near the affected part ; but not on the stripe of red integument, otherwise erysipelas might ensue. If it be an object to procure an open state of the vein—as, for example, when painful cedema of the lower limb must otherwise remain—mercurial applications may be used over the affected part, after subsidence of the acute stage.

Sometimes coagulation of the contents, and more or less complete obstruction of the tube, occur in a vein, without apparent inflammatory change in its coats—at all events at the point where the obstruction occurs. This either may be an extension of a coagulum which has formed in connection with disease of the coats of the vein elsewhere, or may be due to continued obstructive pressure on the part. Whether inflammatory or not in its origin, such fibrinous formation has one formidable risk connected with it, through detachment of a portion of the solid matter ; which is carried on with the blood's current, to cause fresh venous obstruction, perhaps, at a more advanced point, or by passing on to, and through, the right side of the heart, to become impacted in the pulmonary arterial circulation, and to cause all the terrible results of embolism there.

Fig. 191. *a*, The femoral vein, occluded by solidified contents. At *b*, the saphena enters ; and consolidation ends abruptly there.



Fig. 191.

Another risk is by softening of the clot ; this melting down, as it were, into a puriform fluid—if not sequestered from the course of the venous circulation by newly added coagula—mingles with the onward current of the blood, enters the general circulation, and may give rise to the fatal complication of pyæmia.

II. SUPPURATIVE PHLEBITIS.—This is often of traumatic origin. It may occur in one of two forms ; Limited or Diffuse ; the former comparatively safe, so long as the character of limitation is retained ; the latter invariably fraught with the utmost danger. 1. *Limited*.—The morbid process commencing of a minor grade, the same results ensue as in obstructive phlebitis. Coats are thickened ; contents are solidified ; circulation is arrested at that point. Then suppuration takes place ; and the pus mingles with the coagulum, which becomes softened and broken up. How the pus is formed is a matter somewhat in dispute. Formerly it was supposed to be a secretion from the lining membrane of the vein ; but latterly it has been thought that such a non-vascular tissue is incapable of such rapid and profuse secretion, and that the pus therefore comes from without, by implication of the external coats and surrounding areolar tissue ; the non-vascular serous coat becoming disintegrated, and ulceratively crumbling away, while the others furnish the inflammatory secretions. However formed, the pus constitutes an abscess of the venous tube ; the soft parts sympathizing in the ordinary way. Above and below the suppurated part of the vein, the incorporation of coats with contents is not disturbed. Dykes, composed of dense and adherent coagulum, remain ; presenting a salutary barrier to the irruption of pus into the open portion of the vessel, and thence into the general circulation. The constitutional symptoms are of the inflammatory type ; more marked than in the simple obstructive form.

2. *Diffuse*.—Here all gives way before acute and spreading suppuration. There is no bulging tumour ; no indication of matter accumulating and gradually approaching the surface. All is rapidly and diffusely infiltrated. The morbid condition is very similar to that of phlegmonous erysipelas. The outer coats of the vein and the surrounding areolar tissue are infiltrated by unhealthy suppuration ; and the inner coat of the vein, perishing, lays the vessel's tube open to pus from without and softened coagulum from within, which, unless confined by fibrinous dykes on the cardiac aspect, as most probably will not be the case in this asthenic form of disease, mingles with the circulation, and must do evil there. Constitutional symptoms, preceded by rigors, set in of the most urgent kind ; first irritative, then typhoid, and tending to rapid and fatal prostration.

The disease may have been from the first of this kind ; then the symptoms, too, from the very commencement, are urgent. Or the limited form may have degenerated into the diffuse ; the protective dykes having stood for a time, but at length giving way before disruptive inflammatory progress. In the latter circumstances, the occurrence of change from the limited to the diffuse is marked ; locally, by dispersion of the soft swelling ; constitutionally, by intense shiverings, followed immediately by formidable constitutional aggravation.

In whichever way the diffuse form supervene, in the greater num-

ber of cases it proves fatal ; not by extension to the heart, as has been already stated ; but by the typhoid symptoms consequent to, and doubtless dependent on, not merely extensive and rapid disintegration of infiltrated tissue, but also the direct and copious admixture of noxious fluids with the circulating blood. In short, the condition of pyæmia is established ; and the fatal issue is usually accelerated by the formation of *purulent depôts*—their most frequent site being in the lungs.

In the treatment, our chief object is to prevent suppuration if possible—when the case is seen early enough to admit of this. If the symptoms do not at once display the asthenic characters, blood may be taken from the part by leeches or puncturing. Absolute repose is maintained ; of the whole body, and more especially of the part. Hot fomentation is diligently used ; medicated by a weak solution of acetate of lead with opium. Should we succeed thus, in either preventing suppuration altogether, or in confining it to the limited form, the event is fortunate ; the constitutional disturbance is slight, life is not perilled, and the local change can be easily recovered from. Should we fail, however, as is not unlikely ; should suppuration not only occur, but become plainly of the diffuse form—then blind adherence to antiphlogistic treatment were but infatuation. Low symptoms are already setting in ; the system already has begun to yield. The whole plan of treatment must be at once changed ; prostrating remedies being desisted from, and stimulants held in readiness for free yet cautious and skilful use. Our duty then is to support the system, by prudent stimulation ; and soothing symptoms by opiates and otherwise, as circumstances may seem to require.

Blisters, applied in narrow strips over the inflamed vein, are highly extolled by some, and reprobated by others. In this country, the preponderating opinion seems not in their favour. In obstructive phlebitis they are more suitable ; should chronic inflammatory disease prove obstinate. For they may have a favourable effect in arresting this ; at the same time promoting absorption of the consolidated contents.

In limited suppuration of a vein, the same treatment is to be followed as in ordinary acute abscess. A free and early incision is made ; followed by fomentation, poultice, and rest. No unwonted hemorrhage occurs ; the venous canal being obstructed on each aspect of the suppurated part. The cavity granulates, and closes in the ordinary way. Should incision be delayed, there is danger of the protective dykes yielding before the pressure of accumulating pus, and of the case being thus unfortunately converted from the limited form into the diffuse ; from a comparatively trifling affection into one which most frequently terminates in death.

Seeing the importance of fibrinous dykes, it has been proposed artificially to induce their formation in urgent cases of phlebitis, by applying potass, or other caustic, to a portion of vein on the cardiac aspect of the affected part. The attempt has failed, however, as might have been expected ; the phlebitis induced proving not obstructive, but suppurative ; the original disease not becoming limited, but extending and still diffuse.

Such being the dangers of phlebitis, it surely follows that the exciting causes of that disease, in the traumatic form, should be most carefully avoided ; in other words, that we shun interference with the venous

tissue in operations as much as possible. Surgical opinion, no doubt, is divided upon this subject. One class of practitioners have no dread of tying veins, and do not hesitate to do so, when venous hemorrhage is at all troublesome. Another, possessed of a salutary fear of phlebitis, withhold the ligature, unless under circumstances of the most extreme urgency; and at all times are chary of disturbing the larger veins, by knife, finger, or forceps. In the latter class I would beg still to be included. Surely, if we err at all, it is well to do so on the side of safety.

It should also be borne in mind, that the bad air of hospitals predisposes strongly to the occurrence of phlebitis of the worst kind; and that therefore, in public practice, we should be especially careful of interference with the venous tissue; while at the same time we abstain from over-crowding of wards, and take every other means in our power to avoid induction of noxious atmospheric influence.

VARIX.

By this term is understood an enlarged, elongated, and tortuous condition of the veins of a part; sometimes deep-seated, oftener intermuscular, and most frequently superficial. Often the intermuscular and subcutaneous vessels are simultaneously involved. Dilatation is not uniform but bulging, and is usually greatest at the site of the valves. These, no longer proportioned to the enlarged calibre, have become inoperative; they exert no influence on the circulation; and ultimately shrink and almost disappear, in obedience to Nature's law that what has become useless is taken away by absorption. The coats are not attenuated; but, on the contrary, are thick and rigid. The disease seldom occurs till after adult age.

The limb beneath is liable to œdema; and its vital power, as well as its ordinary function, are more or less impaired. It is prone to assume the inflammatory process on its surface; and this tends to the production of troublesome Eczema, or to the formation of ulcers of various kinds—the irritable variety perhaps predominating. The ulcer, spreading, may perforate the vein; and troublesome hemorrhage ensues. Pain and a sensation of weight usually attend, independently of ulceration; and sometimes neuralgia occurs in the part affected.

The direct cause of varix is whatever obstructs venous return; for example, pressure on the venous trunk above, as by distended rectum, enlarged uterus, or any other tumour. It very frequently makes its appear-

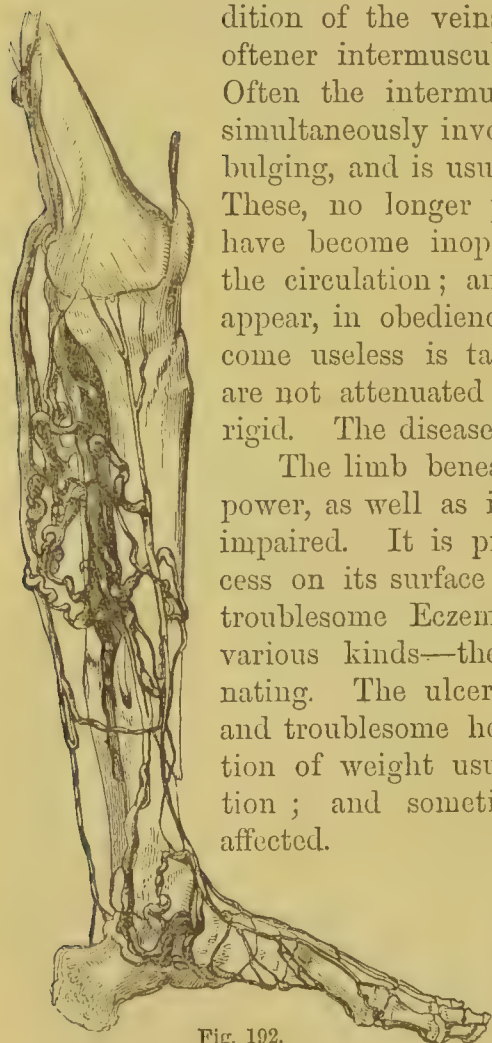


Fig. 192.

ance in the lower extremities in young females about the period of puberty,

Fig. 192. Varix of the veins of the leg.

and tends to exacerbation at each menstrual period. The congestion of the pelvic viscera and efferent veins, affording a remora to free circulation through the external iliac veins, probably serves to explain this undoubted correlation of varix with the commencement and progress of menstruation. As already stated, a predisposing cause is also probably in operation in many cases; namely, venous degeneration—in some respects analogous to the chronic change favourable to dilatation of the arterial tissue.

The parts of the venous system most frequently affected are—the superficial veins of the lower limbs, and of the abdominal parietes; the veins of the spermatic cord; and the lower hemorrhoidal veins, at the verge of the anus. Sometimes varix occurs in the upper extremities, in consequence of sudden and violent muscular exertion, which may have caused partial laceration of the venous coats, at one or more points, afterwards followed by obstruction.

Treatment.—A spontaneous cure may result, by the accession of plastic inflammatory change in the affected veins; their canals becoming consolidated, and constituting a hard indolent swelling, which, by absorption, ultimately disappears; and the blood finding another outlet, by a collateral route. Like the spontaneous cure of aneurism, however, this is not sufficiently frequent to allow of its being trusted to in practice. Cure must be sought, not merely hoped for. It may be palliative or radical.

1. *Palliative.*—Bearing in mind what was formerly stated regarding the propriety of not unnecessarily interfering with the venous tissue by operation, and also remembering that varix is in many cases rather a deformity and inconvenience than a disease of itself dangerous to life, it will be readily understood how this mode of treatment should be regarded as the more generally applicable. It consists in removal or modification of the cause, and in affording support to the dilated vessels. The rectum is emptied, and kept habitually clear, by suitable laxatives; and if other compressing agents are in force, they too must be removed, so far as may lie in our power. In the case of pregnancy, we patiently wait for the natural relief by parturition. If hepatic derangement be indicated, the suitable remedies must be employed. All external ligatures on the limb—as garters—must be removed. All menstrual irregularities should be attended to; and, if painful, the patient should maintain the recumbent posture during the menstrual access.

The erect posture should not, when varix is fully developed, be long maintained at any one time. And uniform support of the affected part is to be afforded, by bandaging or a laced stocking—or by what is better than either, in most cases, an elastic stocking; well fitted, and tight enough to diminish the venous calibre and volume of blood; not only preventing increase of the disorder, but giving an opportunity for contraction and partial recovery, should sufficient tone remain; yet slack enough to admit of motion, and free circulation of the limb.

If the patient do not grudge the leisure and confinement, more active measures may be adopted. Maintaining the recumbent posture, pressure may be applied with more intensity, and without chance of interruption; as by the starched bandage, or by encasing the limb in a mould of gypsum. After the perseverance of a week or two, the dressings may be

undone ; with the hope of finding not a mere temporary alleviation, but perhaps a permanent and effectual cure ; partly by obliteration, but mainly by restoration of the normal calibre and tone.

It is no uncommon thing for life to be brought into peril, or even lost, through a simple varix. Suppose, as often happens, that a patient in the lower ranks, much in the erect posture, and following a laborious avocation, has varix of the leg, with ulcer of the superimposed integument. Suddenly, the vein may give way by ulceration ; or a knife, hatchet, or other tool, makes an accidental wound. Profuse hemorrhage occurs ; much blood may be lost in a few minutes ; the patient faints ; ineffectual means are taken by the bystanders to arrest the bleeding ; he recovers ; the hemorrhage returns ; and, by its repetition, he may be fatally exhausted ere surgical aid arrive. Many lives might be saved were it more generally known that, in all cases of venous hemorrhage, gentle but accurate and steady pressure of the finger or thumb, on the bleeding point, will effectually restrain the flow.

2. *The Radical Cure.*—This depends on effecting obliteration of the affected veins. They may be directly incised, and compressed. Suppuration of the wound necessarily follows ; and if it heal kindly by granulation, obliteration of the venous cavities will doubtless be obtained. Or a portion of the vein may be excised ; and pressure may be applied to each cut extremity, so as to restrain bleeding, and favour fibrinous occlusion. Or the vein may be cut down upon, and encircled by a tightly drawn ligature ; as if it were an artery. All these three modes are doubtless perfectly equal to the obtaining of the desired oblitative result ; but experience has shewn that the inflammatory process seldom ceases short of phlebitis in its worst and most dangerous aspect. Many patients, endeavouring thus to free themselves from the inconvenience of a mere varix, have lost their lives.

If incision be attempted at all, it ought not to be direct, but by the subcutaneous method of puncture ; so as, if possible, to avoid suppuration in the wound. Pressure is required afterwards, to restrain the escape of blood and prevent infiltration of texture. It should not be severe ; a very moderate degree, if applied and maintained with accuracy, is sufficient to arrest venous flow ; and severity, coming after wound, is tolerably certain to induce what we wish to avoid. This method was at one time practised by Brodie, but with indifferent success. Now that the principles of subcutaneous section are better understood, the execution might be more skilful, and the issue more prosperous. But still two difficulties must remain ; first, the risk of inflammatory excess, and danger to life thereby ; second, the chance of speedy healing of the wound, the vein at once uniting and resuming its unbroken flow, just as before the operation.

Modern experience and opinion are now in favour of two other modes of treatment ; cauterization, and application of the twisted suture. The most convenient mode of applying *caustic*, is in the form of what is termed *Vienna paste* ; equal parts of quick lime and potassa fusa. An incision is made through the skin, over that part of the vein which we wish to obliterate ; and a few minutes are permitted to pass unoccupied, that capillary oozing of blood may cease. Then, the surrounding textures

having been protected by a piece of plaster, with an aperture in its centre—the aperture corresponding to the exposed part of the vein—a portion of paste is applied in contact with the venous tissue, and there retained; either permanently, or only for a time, according to the size of the portion applied, and the extent to which we wish to make the eschar. The object is to produce a complete slough of the venous coats; to be followed by a surrounding areola of sthenic inflammatory process, giving plastic change; whereby the venous canal may be obstructed permanently, for some distance above and below the cauterized point. And then the suppuration and ulceration, necessary for detachment of the slough, are not likely to extend beyond the mere vicinity of the dead part.

This cauterization may be employed in two ways. It may be applied to a sound part of the great venous trunk, above the varicose branches; to the saphena in the thigh, for example, in the case of varix of the leg; pressure being at the same time used to the dilated veins. The effect of obstruction above is expected to be, that the blood will seek another channel—collateral, or in a deeper plane; and that consequently the affected veins, much disburthened, and now comparatively idle conduits, may have an opportunity either of recovering their calibre and tone, or of being obliterated by consolidation. Or the caustic may be applied to the dilated veins themselves, at various points, so as to ensure obliteration.

For some days before the caustic's use, the patient should maintain recumbency, and otherwise undergo the same preparatory treatment as for operation on account of aneurism. During the whole progress of cure, recumbency, antiphlogistic regimen, with absence of all excitement, must be observed; and, at the time of the slough's separation, precaution should be doubly vigilant. At this period, were the patient to get out of bed and walk about, or indulge imprudently in diet, hemorrhage—great, and perhaps fatal—might possibly ensue. And further, that being the period of ulceration of the venous coats, for detachment of the slough, such imprudence might very probably lead to extension of the phlebitis.

It is also to be remembered that, independently of all immediate risk, the caustic sores may prove indolent and slow to heal; perhaps becoming a source of even greater inconvenience than the original malady, on account of which they have been incurred.

The twisted suture is applied directly to the affected vein, in the following manner; and is generally preferred, as the simpler and safer mode of treatment. A needle, such as used for harelip, is passed beneath the vein—taking great care that the coats are not in the least degree injured; and round it a silk or thread ligature is twisted, so as to completely obstruct the venous canal at that point, and compress the coats with some power against the needle. This application is permitted to remain undisturbed for some days. Should much pain, swelling, and redness occur, then the needle is withdrawn; the inflammatory process is sufficient for occlusion; and it would be imprudent to seek a higher grade by continuance of the exciting cause. If, however, no uneasiness be complained of, beyond what is ordinary and desirable, the needle may be

permitted to remain undisturbed, until it becomes spontaneously detached by ulceration. For, in those cases in which the application has been but temporary, experience has shewn that renewed circulation is liable to occur, at the part supposed to have been obliterated. And, accordingly, it is well to apply the ligature very gently at first, so as to avoid all risk of being compelled to remove the application too soon. It is better that the threads should be so slack as to render the progress even tedious, than that tightness should either induce a dangerous inflammatory process, or render it expedient to risk an abortive result by premature removal of the sutures.

Points of suture are applied, in this way, at various parts of the dilated vein, or veins; so arranged, as to site and number, as most



Fig. 193.

favourably to conduce towards the oblitative result. With this, some (Lee) recommend the subcutaneous section of the occluded vein or veins; while others practise injection of the insulated portion, with the perchloride of iron—using for this purpose the syringe of Pravaz, or the little instrument employed for the subcutaneous injection of morphia. The same preparatory and attendant treatment is necessary, as for the remedy by cauterization. And let it ever be remembered, that there is not only greater risk from, but greater probability of, too much than too little of the inflammatory accession.

Should erysipelas attack the part, the needles are at once withdrawn. And the anti-erysipelatous treatment behoves to be specially alert; seeing that by its invasion suppurative phlebitis has been rendered very imminent.

After the radical cure, in whatever way attempted, the erect posture and laborious avocations ought to be very gradually resumed; and uniform support, by an elastic bandage or stocking, should be afforded to the affected parts for a long time. Otherwise, return of varix, even in the same vessels, is more than probable. For the venous tissue in no respect more widely differs from the arterial than in this—a proneness to resume the open state, after apparently complete occlusion. And though the shut vessels remain unaltered, their collateral neighbours, now busy in the dropped function of the others, are very apt to assume the varicose change.

And again, let it be well understood that some risk, by phlebitis, attendant on the simplest and best of these methods of radical cure, does always exist; that, therefore, both patient and surgeon should rest con-

Fig. 193. Obliteration of varicose veins, at three points. The radical cure.

tented with the palliative mode of treatment, unless in those cases in which the inconvenience is great, and obstinate and serious ulceration attends, perhaps with hemorrhage ; and that, under no circumstances, ought the surgeon to undertake the operation, far less urge it, unless the patient be made fully aware of the amount and kind of risk which is necessarily incurred.

Phlebolites.

By this term is understood concretions which form in the fibrinous coagula of varicose and obstructed veins ; sometimes merged in the substance of subsequent solid enlargement, more frequently constituting small hard swellings of their own. Their earthy matter is mainly phosphate of lime. The only remedy is by excision : but this need not be resorted to unless the concretion gives rise to uneasiness.

ENTRANCE OF AIR INTO VEINS.

This is a casualty of a most alarming nature ; and may occur during operations which implicate section of the larger veins. In wounds of the lower part of the neck and of the axilla, a venous orifice is apt to become gaping, or “canalized,” during deep inspiration ; and then atmospheric air will enter in greater or less quantity.

Certain circumstances favour the accident's occurrence. 1. The site of the wound. The lower part of the neck, and upper part of the thorax, are the most dangerous localities. 2. The condition of the venous coats. If thickened and rigid, by chronic change of their coats, they tend to remain open when cut ; like an arterial tube rather than a venous ; a condition most favourable to the air's entrance. 3. The state of the surrounding parts. These may be dense and consolidated, so as not to permit contraction of the venous orifice ; maintaining it widely open, as in section of the hepatic veins. Or spasmodic contractions of the muscles may have a similar canalizing effect. 4. The degree of traction made upon the vein. The vessel, if loose when cut, is not so apt to gape, as when tightened by pulling ; as it often may be, at the time of section, in the extirpation of tumours. 5. The form of wound in the vessel. The vein, if completely severed, is likely to collapse. If cut only partially, and in a transverse direction, while by traction it is made tense, the aperture cannot choose but gape. 6. Position of the part operated on. If relaxed, collapse of the venous orifice is favoured ; if, on the contrary, placed on the stretch, as usually is the case to a greater or less extent, to facilitate dissection, canalization is rendered more likely. 7. The position of the vein in the wound. A large vein punctured, and situated in the angle between two flaps of a wound, is probably made to gape at each opening up of the incision.

Canalization of the vein, combined with deep inspiration, is all that is required ; and it is consequently matter of surprise, that the untoward event should not be of more frequent occurrence. The symptoms which denote it are as follows :—A noise of air in motion through a narrow space is heard ; sometimes hissing ; more frequently of a lapping or

gurgling sound. This is immediately followed by a convulsive struggle; often preceded by a sudden exclamation expressive of impending danger or death. On auscultation, a "churning noise is heard in the heart, synchronous with the ventricular systole;" and the hand applied to the chest "perceives at the same time a peculiar bubbling, thrilling, rasping sensation, occasioned by the air and blood being, as it were, whipped together" within the ventricle.* If but a few particles of air have entered, the alarming symptoms pass away, and the patient rallies. If, however, the entrance have been copious, convulsions continue; syncope occurs, and is permanent. In some cases, death has proved quiet and rapid, as if by simple syncope; no convulsive movements having taken place. In most, it is a struggle to the last.

For some time after respiration has ceased, the heart continues to beat; it is the *ultimum moriens*, in this instance. It might be supposed that the air distending the heart would clog its action; and that death would begin there. But it is not so. The mode of death would seem to be the following:—The blood becoming mingled with air, assumes a frothy character in the right ventricle, and thence is sent through the pulmonary artery; but is more or less arrested in the pulmonic capillaries, or terminal branches of the pulmonary artery, in consequence of the right ventricle being unable to overcome the mechanical obstacle presented by air bubbles in these vessels. The quantity of blood transmitted through the lungs, for the systemic circulation, grows less and less; according to the increase of obstruction and arrest in the lung's capillaries. The supply to the head is inadequate to afford due stimulus to the nervous centre; and syncope results. If circulation be not restored, the syncope continues; the respiratory movements then cease, and life becomes extinct; the heart last failing in its action, from want of its necessary stimulus, the blood.

When operating in the dangerous localities of the neck and trunk, care should be taken to prevent this accident. The chest and abdomen may be tightly bandaged, previously to the commencement of the operation, during its performance, and for some time after its completion; to prevent deep inspiration—the state most favourable for the air's entrance. But the careful employment of anæsthesia secures a like favourable tendency, more simply, and with equal certainty. The larger veins should be avoided as much as possible by the knife; and when cut, of necessity or by accident, means should instantly be adopted to prevent the occurrence of those circumstances which are favourable to canalization. Perhaps the most effectual means is to shut the orifice by an assistant's finger, until the operation is completed.

Air having entered, as indicated by the peculiar noise, and the alarming symptoms which immediately follow, instant and firm pressure is to be made on the venous orifice or orifices, and accurately maintained, so as to prevent further ingress. Then, our attention is to be directed to prevention of the fatal result. The first indication is, to maintain due exercise of the cerebral functions, by furnishing, if possible, a suitable supply of arterial blood. For this purpose, we must husband the small available systemic circulation; determining it to the head, and leaving

* Edinburgh Medical and Surgical Journal, January 1844, p. 6. Erichsen.

the rest of the body for a time but barely supplied. The patient is to be placed recumbent, with the head low, as in ordinary syncope; while by compression of the abdominal aorta, and both axillary arteries, the blood is limited in circulation to the upper part of the body; or, if obesity render pressure on the aorta difficult, both femoral arteries are to be compressed. The second indication is, to maintain the action of the heart, by artificial respiration, galvanism, and friction at the præcordial region; thereby affording time and opportunity for removal of the obstruction in the pulmonic capillaries, and consequent restoration of the normal circulation. Ammonia to the nostrils, turpentine or brandy as an enema, and aromatic spirits of ammonia, if the patient can swallow, should be employed. Should we thus succeed in averting the immediately fatal result, means must be taken to prevent or moderate the accession of congestive affections of the lungs, which are apt to ensue.

Air forcibly injected into a vein, as by insufflation, produces death almost instantaneously. In this case, death commences in the heart, which is distended and paralyzed by the large amount of air forcibly intruded. Such an event is not likely to occur, however, in the human subject. It has been proposed, in such circumstances, to introduce a flexible catheter into the external jugular vein, as a means of abstracting the air which, according to some, is presumed to occupy the right side of the heart—impeding its action, and by its propulsive effect upon the blood contained in its chambers inducing the anomalous combination of asphyxia and syncope which these cases present. To be of any real service, this operation would require instantaneous performance, and imply the presence of a very considerable quantity of air to be accumulated within the cavity of the right auricle and ventricle.

CHAPTER XVII.

AFFECTIONS OF THE LYMPHATICS.

ANGEIOLEUCITIS.

Angeioleucitis, or *Lymphangitis*, is of very frequent occurrence. It may appear without any appreciable cause ; more commonly it is the result of external injury. The superficial lymphatics are most frequently involved. And the inflammatory process seems, in the great majority of cases, to be connected with absorption of deleterious matter ; either from without, or generated in the part as a product of disease.

If a wound exist it becomes inflamed ; and the affection has a tendency to the erysipelatous character. Painful sensations shoot upwards ; and streaks or bands, of a bright redness, appear on the previously sound skin ; not necessarily continuous with the original inflammatory process, but perhaps at some distance from it ; tortuous, irregular, and intersecting each other, so as to form small islets of skin yet unaffected ; following the course of the superficial lymphatics ; and dependent on an erythematous condition of the skin above the inflaming vessels. Sometimes the limb presents an appearance as if attacked by slight erysipelas, at many unconnected points. The pain is hot and burning, and increased by pressure ; and the lymphatic vessels feel hard and corded. The general swelling is usually considerable, often great ; and affords a spongy sensation. The red streaks extend upwards, often with much rapidity ; sometimes continuous throughout, but quite as frequently shewing portions of skin apparently unaffected. The ganglia, in their course, become involved ; and swell acutely and painfully. Very frequently erysipelas supervenes ; the distinct streaks of the angeioleucitis then becoming merged in the general and continuous redness of the new disease. According to some pathologists erythema and erysipelas are only forms of the inflammatory process affecting the terminal lymphatics of the surface. If this really be the case, the conjunction of angeioleucitis and erysipelas need be no wonder.

The constitutional symptoms are usually ushered in with rigors, and at first evince the true inflammatory type. Sometimes a simply febrile state, as in erysipelas, precedes the appearance of local disorder. As the latter advances, the inflammatory type of the constitutional symptoms is more or less rapidly departed from ; and, in the great majority of cases, at all severe, the irritative or typhoid characters are ultimately developed. Sometimes such is the type of the general disorder from the beginning ; dependent partly on previous weakness of system ; partly, as in all advanced cases of the disease, on the introduction of deleterious matter into the circulating system—a product of the inflammatory process.

Resolution may occur ; the process stopping short of suppuration ; and the part gradually recovering from the inflammatory change. Or the affection either originally or secondarily of a chronic form, may cease ; and yet resolution may not ensue ; the part remaining indurated, and absorption taking place very tardily if at all. Or the process, acute, proceeds to suppuration, which is indicated by the ordinary signs ; sometimes assuming the character of abscess, or of a chain of abscesses ; more frequently, perhaps, the matter is diffusely infiltrated, the general symptoms becoming aggravated in consequence.

Treatment is in the first instance antiphlogistic, but under the same restrictions as in the case of phlebitis. In addition to the ordinary means, of leeching, rest, regimen, purging, etc., much relief is often obtained from the assiduous application of a hot and weak decoction of acetate of lead and opium (prepared by boiling) to the part affected. When suppuration occurs, whether diffuse or limited, the matter should be evacuated by early and free incision. In the chronic form, threatening to leave induration, blistering is advisable. In acute and aggravated examples, the same principles must guide as in the analogous case of phlebitis ; support of the constitution, mitigation of the symptoms, and hope in the system's effort at revulsion and recovery. In those cases in which the constitutional disorder is from the first asthenic, active antiphlogistics are never expedient.

Not unfrequently, erysipelas, phlebitis, or even both, co-exist. Such addition renders the prognosis unfavourable ; and demands modification of treatment, to suit the circumstances of complication.

Inflammatory swelling of the lymphatic ganglia — Adenitis — as already stated, attends the spread of angeioleucitis. But, besides, it often occurs independently of such preliminary disease ; the result of irritation, either direct, or conveyed from a distant part, and connected or not with absorption of deleterious matter. Simple strain, or ulcer, or wound of the foot, for example—as well as direct injury of the part itself—may induce acute inflammatory swelling of the inguinal glands ; and the same parts are quite as frequently affected in an inflammatory process, more troublesome if not more intense, from ulceration of the penis of a specific kind, accompanied by absorption of chancreous virus.

In Adenitis the swelling is rapid, prominent, and very painful ; attended with more or less constitutional disturbance, of the inflammatory type. The bulk mainly depends on infiltration of the parenchyma, or ordinary areolar tissue of the gland ; in which the inflammatory process would seem chiefly to reside. The conglomerated tubes themselves undergo change, such as usually results from acute inflammatory affection of that tissue ; alteration of the coats, and of the secretion, sometimes coagulation and obstruction, which, if extensive and continued, may lead to important cedema of the parts beneath. The infiltration of the parenchyma may be simple and plastic ; soon disappearing, by absorption, on subsidence of the disease. Or suppuration takes place ; and abscess forms, either in the substance of the gland, or in the areolar tissue on its exterior. Or the new product, continuing plastic, does not resolve on subsidence of the

inflammatory process ; but remains, forming an indolent and firm enlargement.

In most cases—more especially those unconnected with absorption of deleterious virus—it is our object to arrest the process and obtain resolution. Local depletion, by leeching, is naturally had recourse to ; but experience says little in its favour. There are comparatively few examples of its apparent success ; on the contrary, the irritant effect of the application often seems to hasten the process onward. If leeching is employed, let it be at a little distance from the part affected. Usually, however, more trust may be reposed in other antiphlogistics ; rest, diligent fomentation, relaxing position, antimony or aconite, and low regimen.

If the crescent affection be of the sub-acute form, benefit may often be obtained from the application of iodine, or nitrate of silver in solution, so as to desiccate and discolour the integument. Many a simple and sub-acute bubo may be thus arrested ; at the same time maintaining rest and antiphlogistic regimen.

When matter has formed, incision is to be made as under ordinary circumstances. The suppuration is usually both profuse and long-continued. After incision, poulticing and fomentation are employed for a few days ; then water-dressing, medicated or not, as circumstances may require. And ultimately pressure is advisable ; to hasten absorption of fibrinous infiltration in the gland's parenchyma, and at the same time to favour closure of the suppurating track and cavity.

If suppuration have taken place only in the subcutaneous areolar tissue, the skin is usually undermined. The opening becomes large, and closure is delayed by projection and interposition of the yet entire glandular tumour. In such circumstances, pressure is to be tried ; directed with some energy on the offending part. And if this fail, the prominent gland may be dissected out or removed with scissors ; or, should a sinus lead to its interior, potassa fusa may be freely applied by impenetration, so as to ensure thorough disintegration of the mass. Thereafter, the sore is to be treated in the ordinary way.

Sometimes a glandular enlargement, originally acute, ceases to be so ; and hangs undecided between progression and recedence. For this state nothing is so suitable as a blister. It decides the question in one way or other ; either absorption or suppuration follows.

In the truly indolent swellings, pressure is employed, with the application of the gum and mercurial plaster, or occasional counter-irritation ; and the iodide of potassium is given internally. Where constitutional debility exists, the iodide of iron may be preferable ; and cod-liver oil is often of great service. Should the method by discussion fail, both part and system may be continuously stimulated, so as to induce suppuration in the changed part.

Suppurating buboes, of specific venereal origin, require certain peculiarities of treatment, as will afterwards be noticed.

The treatment of scrofulous glandular swellings has been already sufficiently detailed under the head of Scrofula.

Glandular Tumours.

Nothing is more common than enlargement of the lymphatic ganglia. But the great majority of such swellings have their origin in simple inflammatory affection; never requiring the extirpating knife; always amenable either to discussion or to suppurative disintegration. Occasionally, however, the glandular parenchyma is the seat of genuine tumour; perhaps supervening on simple inflammatory enlargement; more frequently wholly independent of this. In the latter case, one or two glands only are affected; not a whole cluster or chain. The growth is more steady, the swelling more distinct; and, in other respects, the characters of the enlargement are such as belong to tumours generally.

CHAPTER XVIII.

AFFECTIONS OF THE NERVES.

NEURITIS.

THE effects of the inflammatory process on this tissue are, of course, most apparent in the nervous centres ; but there seems no reason to doubt, that similar effects follow similar causes in the nervous ramifications also. The first change is tumescence, with increase of the supply of blood. On making a section of the affected part, numerous red spots are seen, marking the blood-vessels ; and in some places there may be a red striated appearance, in consequence of extravasation ; sometimes small coagula are found. The increased amount of blood may heighten the general colour of the affected part ; the cortical substance assuming a dark red or brownish colour, while the medullary is of a lighter tint. The process continuing, the ordinary inflammatory products result by proliferation of the nuclei of the cell structures, which, in the brain, represent the connective tissue of other parts ; the texture softens, and may become of almost semifluid consistence. According to the nature and extent of the inflammatory products, the colour, density, and general character vary ; if blood be extravasated, the softening is red ; yellow, when this is not the case ; sometimes gray, and occasionally whitish, or but little altered from the normal hue. The latter condition, as can readily be understood, is the result of a chronic and minor affection. These changes will be found on microscopic examination to be due partly to vascular changes, partly to corpuscular multiplication of the connective tissue, and partly to the fatty degeneration of the inflammatory product along with the brain substance.

The cineritious matter is more prone to undergo such changes than the medullary ; probably on account of its containing a larger proportion of cell structures capable of engaging in the proliferating process.

Softening of the brain substance, found after death, may, however, be unconnected with the inflammatory process. The distinguishing of such post-mortem disorganization from that which is truly inflammatory sometimes requires minute and careful examination. Generally speaking, the former is more diffused, or, if localized, has an obvious cause in the existence of embolism of the afferent vessel of the affected part ; or in the presence of extravasated blood or other agent leading to mechanical disintegration of the tissue. Under the microscope, nothing is found but disorganized and macerated nervous texture ; while in the inflammatory softening, changes in the connective tissue corpuscles, and the formation of so-called compound granular cells are observed.

The nervous tissue is not exempt from suppuration, but, compared

with other soft textures, is very rarely affected by this result of the inflammatory process. The pus may be intermingled with broken down nerve tissue, as in the more recent forms of softening; or limited, as in ordinary abscess, by its cyst, and by condensed tissue around. The abscess may be acute; following the ordinary course, and marked by symptoms of great intensity; or chronic—most insidious in its progress, and consequently of a highly dangerous character.

Induration and enlargement of structure follow chronic inflammatory disease; and are usually the remote result of some injury done to the part.

Disintegration of tissue is doubtless concerned in the process of softening; peculiar to acute inflammatory change, but not necessarily, in the cerebral substance at least, accompanied with suppuration. In progressive ulcer of the surface, however, wherever situated, nervous trunks, though for a time resistful of the destructive process, ultimately give way before it. Sometimes ulcer seems specially to implicate the nerve, giving rise to most violent and painful symptoms; when, for example, that tissue has become the seat of inflammatory affection subsequently to laceration, bruise, or other similar injury, or is implicated in an irritable ulceration of the surface.

Sloughing is fortunately comparatively rare; yet may occur as in other parts. The nerves of a limb may be implicated in sloughing of the soft parts, as do the other component textures; and sloughing of the protruded cerebral mass is also seen in *hernia cerebri*.

The *Causes* of the inflammatory process in nerves are usually traumatic; puncture, section, laceration, bruise, inclusion by ligature. The idiopathic form is rare.

From simple wound, a minor and somewhat chronic grade of the process usually results; producing bulbous expansion of the cut end of the nerve, by multiplication of the corpuscular elements of the connective tissue which is so thoroughly developed in the neurilemma; a condition termed *Neuroma*, when the swelling is of considerable size, and the seat of abnormal sensations. A similar result usually follows injury by deligation. Puncture, laceration, and bruise, are more likely to be followed by the advanced stage of the inflammatory process; producing softening and suppuration, ulceration, or even death of the part.

The *Symptoms* which attend inflammatory changes in nervous trunks are, in the acute form:—great pain, rendered excruciating by pressure, and shooting in the direction of the nerve or nerves affected; heat and throbbing; not unfrequently a tendency to jerking of the muscles implicated; inflammatory fever of a marked and intense character; and, in the more urgent cases, the nervous centres are apt to be involved in obvious derangement of function. When the nervous centres are affected, the symptoms usually indicate the existence of some serious structural change going on; this may however be insidious, and the true nature of the disease may not be unmasked till hopeless change of structure has occurred, in most cases of a surgical kind implicating the brain or spinal cord. The symptoms are referrible to injury, are rapidly developed, and the nature of the affection is easily recognised. In chronic examples of inflammatory change in the nerve trunks, such as result in the formation

of neuroma, the pain may be equally severe, but is not so much aggravated by pressure ; heat and the ordinary signs of the acute inflammatory process are absent ; and the system is not involved in inflammatory fever, but rather wasted by disorder of the adynamic type, resembling an ordinary hectic. If neuroma form and be superficial, the painful, hard swelling can be distinctly felt.

Treatment is conducted according to ordinary antiphlogistic principles ; activity being proportioned to the nature and urgency of the case. *Cæteris paribus*, the nearer the part affected is to the nervous centres, the more important is the case, and the greater the expediency of active measures for relief.

Neuralgia.

This denotes increased and perverted sensation in a nerve ; unconnected with the inflammatory process, or with change of structure, at the part where the pain is felt. The affection is of two kinds ; entirely functional, being unconnected with organic lesion, at any part of the nerve's course, or at the nervous centres ; or, as more frequently happens, connected with organic change, acute or chronic—more frequently the latter—at some part of the nerve's course, or at the nervous centres. The one is an example of pure irritation, or functional nervous derangement ; the other may be termed—irritation, dependent on organic lesion at a distant part of the nervous tissue. The nerves most liable to neuralgia are the fifth pair, and the sciatic ; the former more especially. But all are apt to suffer. Neuralgia may be anywhere ; in the head, face, arms, chest, abdomen, back, legs, or feet.

The pain is intense, but intermittent ; sudden in its onset, also abrupt in its decadence ; shooting or plunging in its character, and often quite excruciating ; readily induced by the slightest external impression affecting the mere surface ; but seldom aggravated by firm pressure on the part ; on the contrary often relieved thereby. Occasionally, delirium seems to ensue from mere severity of suffering. Tic-douloureux in the face—affection of the fifth nerve—is a familiar example of the gravest form. Not unfrequently, the attacks are periodical and regular in their accession ; and muscular spasm is a common attendant on the paroxysm. Some neuralgic patients suffer especially in certain months of the year.

Rheumatic pains not unfrequently follow the course of the nerves ; dependent on affection of the fibrous neurilemma. But such pains are not truly neuralgic. They are less intense, less intermittent, less paroxysmal, and are associated with the ordinary rheumatic accompaniments.

The *Cause* of Neuralgia is usually obscure. There may be no organic change in any part of the nervous tissue, as already stated ; and the origin of the purely functional derangement may prove quite inscrutable. Or there may be disorder of some internal organ ; apparently connected with the neuralgia, in the relation of cause and effect ; the latter disappearing when the former has been removed. A neuralgic pain of the leg or foot, for example, has often yielded to treatment directed to removal of noxious matter from the intestinal canal, with restoration of the normal secretions.

Sometimes the neuralgia seems dependent on an irritation, less formidable than itself, in a different part of the same nervous expansion. Violent neuralgia of the infra-orbital nerve, for instance, is often assuaged, or perhaps cured, by removal of a decayed or otherwise altered tooth, which may have been occasioning but little apparent disturbance in its own immediate vicinity.

A spiculum of bone, or mere enlargement of an osseous canal, may so compress and irritate a passing nerve, as to induce neuralgia in its extreme expansions. And it is supposed, with probability, that similar results may follow compression of a nerve in an osseous canal in consequence of change in the accompanying blood-vessels—expansion by local determination—independently of any alteration in the osseous texture.

Very frequently organic change, existing at some part of the nervous tissue, may reasonably be judged the cause of the neuralgia; a thickening or enlargement of the nerve, at some part; or a disorganization, or congestion, or inflammatory product, at some part of the nervous centre, near the origin of the nerve or nerves affected. In chronic disease of the upper part of the spinal cord, and lower and posterior part of the brain, there is no more frequent or distressing class of symptoms than plunging neuralgic pains, with muscular spasms, in the lower limbs.

But, whatever the exciting cause, there seems to exist some predisposing origin of neuralgia, which we cannot define; a constitutional tendency to the disorder, which may, and does, of itself maintain the malady, after every appreciable cause has been sought for and removed; and which doubtless is the sole origin, in those cases in which no exciting cause can be detected even after death. In the case of neuralgia apparently dependent on neuromata, for instance, these may be taken away by incision, and the wound treated most carefully; yet the same painful feelings are very prone to return, before fresh neuromata have had time to form; and may continue, even when careful manipulation satisfies the surgeon that additional neuromata have actually not been produced.

Hysteria obviously predisposes to the disease, and may sometimes also prove its exciting cause. But in these cases, the pain is not so apt to follow the course of nerves, but rather to settle on the surface of a part, or even in an internal organ.

The termination of the disease is not uniform. It may yield to treatment. Frequently it defies all remedies, and suddenly disappears spontaneously; the cause of decadence proving still more mysterious than that of accession. Or continued irritation may induce serious change in the nervous centres; and the result may be apoplexy, or insanity. Or the irritation may simply exhaust the patient, by emaciation and hectic.

Treatment.—Our first and most obvious duty is, to anxiously seek for and detect a cause, if possible; and, having found it, to effect its removal, if this be in our power. Disorders of the uterus are to be remedied; intestinal irritation, by lodgment of noxious matter, or otherwise, is to be subdued; dyspepsia is to be set right; offending teeth or stumps are to be extracted; neuromata, or painful subcutaneous tubercles,

are to be excised ; foreign matter, lodging in the neighbourhood of the nerve, is to be carefully taken away. If chronic yet recent change of structure be suspected in the substance of the nerve, at some distant point, let moderate leeching, followed by patient counter-irritation, be employed at that part, with the view of remedying such change ; assisted, if need be, by the internal use of iodide of potassium, or other auxiliaries to discussion. If the brain or spinal cord be suspected, treatment should be mainly directed to these important parts. It is not uncommon to find neuralgia connected with great tenderness of certain vertebræ ; and such cases often yield readily to leeching there, followed by counter-irritation and rest.

To the seat of pain, various applications may be made. In some cases, it has been thought that good has resulted from use of the moxa or actual cautery ; but such remedies are more suitable to those parts where actual change of structure is either known or suspected. Soothing applications are more appropriate to the seat of neuralgic pain. Opium, belladonna, aconite, may be used in the form of epithem, ointment, or liniment ; or their salts may be exhibited by the skin—either by inoculation, or after abrasion of the cuticle by vesication ; or, still more efficiently, a solution of morphia or of atropine may be injected into the part—superficially or deep, according to the circumstances—by means of a fine syringe with needle point. This seldom fails to give relief, more or less—at least for the time. Veratria, hydrocyanic acid, and the tincture of physostigma (Calabar bean), are also not without their effect as local anodynes. Simple blistering, dry cupping, rubefacients, and acupuncture, sometimes are of service.

Internally, anodynes may be given. In some cases, it is of the utmost importance to palliate in this manner, without any expectation of cure ; preventing exhaustion of the frame from continued intensity of pain. Opium may thus be found useful in large doses ; and yet it should always be used warily, lest it accelerate and aggravate the cerebral disorder which the disease itself tends to induce. Inhalation of chloroform may sometimes abate a paroxysm ; and can at all times command temporary relief from suffering. But its habitual use is not safe—for obvious reasons. And probably no palliative of this nature is on the whole at once so safe and so efficient as the anodyne injection of the part. The amount injected, as well as the frequency of repetition, must vary according to the effect. Sometimes once every second or third day may suffice ; in other cases the little operation must be done daily. Too frequently the anodyne effect is but palliative and transient ; in some few cases, however, such injection patiently and judiciously persevered in seems really to contribute to the cure.

Not a few remedies are exhibited internally, almost with empiricism ; considered available to counteract that hidden perversion of system on which neuralgia seems much to depend. Subcarbonate of iron is given in large doses ; along with occasional laxatives, to prevent the bulky medicine from accumulating in the interior. It is especially useful in those cases, in which the disease is obviously connected with an anæmic condition. Quinine and arsenic are both of much repute, especially in those cases in which periodical accessions are most marked. Colchicum

is likely to be serviceable, when a suspicion exists of rheumatic origin or complication. Turpentine, too, has proved of use ; especially in affections of the sciatic nerve. Croton oil, used as a smart purgative, has often afforded relief ; acting perhaps on the principle of counter-irritation, besides sweeping away noxious matter which may have accumulated in the interior.

Stimulants of the nervous system have been tried, and with some success. Relief has followed the application of electricity and galvanism directly to the nerves, by means of acupuncture ; as well as the internal use of strychnia, in doses of the twelfth of a grain.

In all cases, it is most important to commence the internal treatment by evacuants, followed by alteratives ; and to persevere in the simple use of these, until the primæ viæ exhibit satisfactory evidence of a normal state, as to contents and secretion. There are but few cases, also, which will not receive benefit by cessation from laborious and anxious avocations, with change of air ; more especially if the change be from a humid, relaxing climate, to one which is dry and bracing.

Interruption of continuity in the affected nerve, by subcutaneous section or excision of a portion, has been tried extensively ; but with so little success as scarcely to warrant repetition of the experiment. In many cases relief is obtained for a time ; but soon there is return of the pain, either at the same site or elsewhere ; probably with aggravation, on account of the structural change which must have inevitably occurred in each end of the cut nerve. Excision, therefore, is now prudently limited to those cases in which an obviously altered portion of the nerve affected can be safely and completely taken away.

Tumours of Nerves.

All tumours are liable to occur in connection with the nervous tissue ; but two are peculiar to it, the *Neuroma*, and *Painful tubercle*.

Neuroma.—This is usually a simple tumour, and of a fibrous nature ; consisting of dense plastic matter lodged amongst the fibrils of the nervous tissue, which are thereby separated, and usually rendered the seat of perverted sensation. Sometimes the formation occurs spontaneously ; more frequently it follows remotely on wound, or other external injury. It may take place in the course of an undivided nerve, such as the median or sciatic ; and specimens exist in different museums of such formation occurring in nearly every nerve in the body—as in the remarkable cases related by Mr. Smith of Dublin ; more frequently the neuroma forms on the truncated extremity of a nerve after division, as in amputation. When in the former situation, it usually arises without any appreciable cause ; is of an oval shape ; and may attain to the size of a prune or small egg. Above and below the enlarged part, the nerve resumes its wonted form and appearance. In such circumstances, although usually of a fibrous character, the neuromatous tumour sometimes presents all the character and progress of medullary cancer. In some cases the tumour involves the neurilemma and fibrils in its structure ; when, however, it is of a purely fibrous nature, the fibres may surround and enclose the tumour without being implicated in its texture.

After wound, as on the face of a stump, neuromata vary in size, according to the original dimensions of the nerves affected. The nerve itself, for some way above, is also slightly increased in bulk, tortuous, and unusually vascular. Under all circumstances of healed wound, the cut portions of nerve undergo an enlargement and condensation. And it is probable that the neuromata are caused by a similar process and change of structure, which have transgressed the limits of expediency. The ordinary bulbous end of a cut nerve, in a stump or other wound, is not painful or inconvenient ; but the neuroma—an exaggeration of this—is both, to a very great degree. Besides, the neuromata, in a stump, are in general intimately incorporated with the hard cicatrix ; which is



Fig. 194.

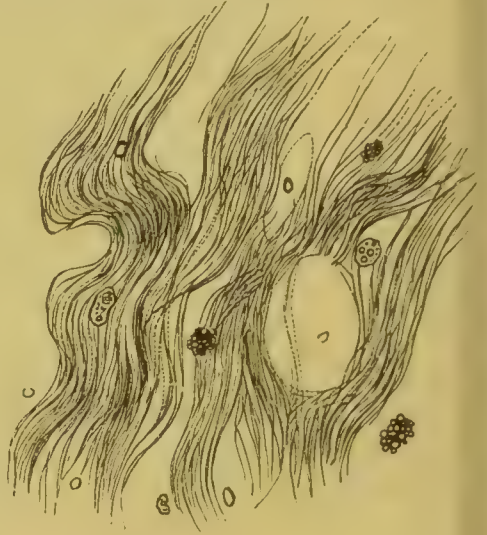


Fig. 195.

tightly adherent to the bone and its dense investing textures. And this circumstance, of itself, might be the cause of much irritation to the nerves which it implicates, even if these were otherwise little altered in structure.

The pain of neuromata is great, though not constant ; increased by pressure, and likened by patients to a galvanic shock ; often presenting all the characters of intense neuralgia ; embittering existence, and greatly deranging the general health. Epilepsy has been known to follow, apparently, from this cause ; hysteria, not unfrequently.

The remedy is by extirpation. In the case of the neuromatous tumour developed on an undivided nerve, the swelling is cut down upon and exposed ; and, the nerve having been cut across at a little distance above and below the enlargement, the diseased part is dissected away from its surrounding attachment ; to which, usually, it but loosely adheres. This entails paralysis of that nerve for a time ; and the ultimate resumption of function will usually be incomplete. But surely the absence of all sensation is preferable to pain of an excruciating intensity. In some cases, however, by a careful dissection, a fibrous tumour developed

Fig. 194. Section of a neuroma ; three nervous trunks terminating in it. The fibrous arrangement shewn, as observed by the naked eye.—SMITH.

Fig. 195. Fibrous structure of neuroma ; from the case published by Dr. Smith of Dublin. After immersion in spirit, which has caused corrugation of the granules and corpuscles.—*From a drawing by Dr. Bennett.*

within a nerve such as the sciatic has been successfully removed, and the function of the nerve retained unimpaired. In the case of a stump, or other wound, if there be one or two distinct and circumscribed tumours, they may be removed in a similar way. But usually they are numerous, and intimately incorporated with the dense ligamentous structure forming the cicatrix. And, under these circumstances, a second amputation is necessary ; taking away all the neuromata, as well as the changed structure in which they are inextricably impacted. In doing so, the nervous section should be made higher than that of the other tissues—by separate division afterwards, the patient being of course fully under the influence of chloroform—in order to make sure that the cut extremities shall not again become entangled in the cicatrix. Sometimes, however, notwithstanding all care in such particulars, the neuromata, or at least the neuralgic pains, return ; a circumstance apparently attributable rather

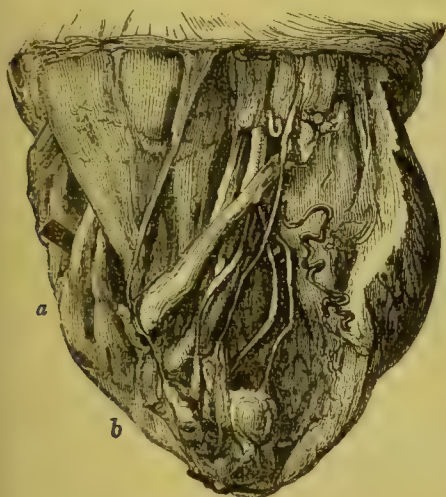


Fig. 196.

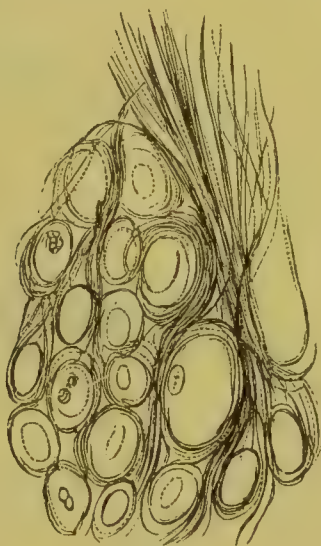


Fig. 197.

to a constitutional than to a local cause, and demanding general treatment accordingly.

That such neuralgic diathesis exists, experience has made but too plain ; often neutralising the results of operations otherwise most promising. And the liability to such a perverted state of system must always be borne in mind, in reference to treatment and prognosis.

In the formidable diathesis where neuromatous tumours occur in different nerves, throughout the whole body, as in the remarkable cases related by Mr. Smith of Dublin, operative interference is manifestly hopeless, and any treatment is likely to prove merely palliative.

Painful Tubercle.—This is often termed also *Subcutaneous* ; its most frequent site being the areolar tissue, immediately beneath the skin ; and sometimes the integument also seems to be partially involved. Occasionally, however, it is found in the intermuscular areolar tissue. The size seldom exceeds that of a pea or bean ; and is often less than either. The structure is usually that of fibro-cartilage, more dense than

Fig. 196. Neuromata of stump, after amputation of the arm. A large neuromatous mass at *a* ; opposite *b*, the tumours are more defined.

Fig. 197. Microscopic section of subcutaneous tubercle, shewing fibro-cartilaginous structure. Corpuscles abundant.—From a drawing by Dr. Bennett.

that of neuroma; and sometimes containing points, if not actually bloody, at least of a blood-like appearance. This last condition, however, may be accidental; the result of external injury. And probably it is so; for the structure, in all other respects, seems to be simple and benign. Another difference from the neuroma is, that whereas in the latter the nervous fibres are very apparent, here the fibrous matter seems to be mainly, if not wholly, a new production. No nervous trunk is continuous with the mass; and only sometimes the minute terminal branches are capable of being traced into it. The tumour is very movable; gliding under the finger. But it is intolerant of the slightest pres-

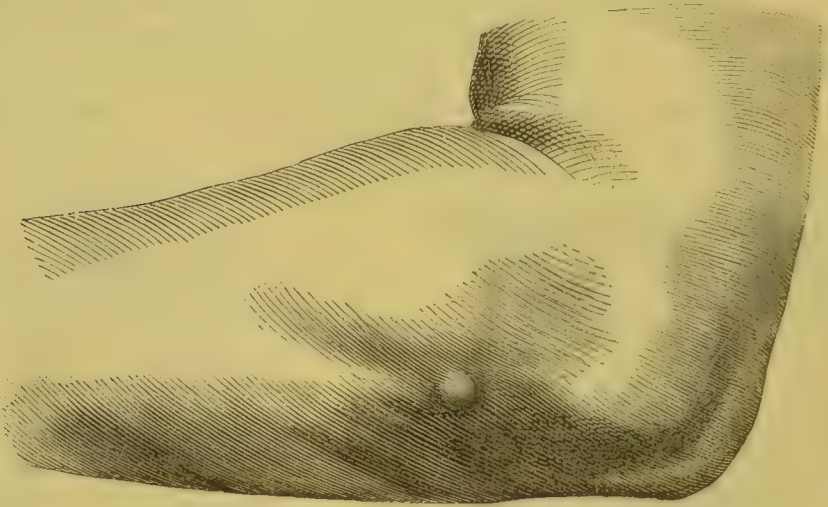


Fig. 198.

sure; intense pain being produced thereby, which the patient—as in the case of neuroma—likens to a galvanic or electric shock. The pain is sometimes paroxysmal; induced by the slightest external influence, and sometimes of spontaneous origin. More frequently than the neuroma, it has been associated with hysteria; but, usually, the general health is less disordered than in neuroma. It may occur in any part of the general surface; but is most frequent in the lower extremities.

Treatment is by excision. If the skin be at all involved, it is to be taken away along with the tumour, to the requisite extent, by means of elliptical incision. If the integument be free, a simple wound suffices. There is no reproduction. Some general means may be subsequently expedient, to calm the nervous system from excitement, which the existence of the tumour may have induced.

Fig. 198. Painful subcutaneous tubercle, on the fore-arm.—SMITH.

INJURIES.

CHAPTER XIX.

THE SHOCK OF INJURY.

MORE or less depression of the nervous system, with a secondary and similar result on the heart and pulse, is usually the immediate result of mechanical injury inflicted on the living frame ; proportioned in extent to the intensity of the external violence, the amount of the frame that is injured, the relative importance of the injured part in the general animal economy, and the previous state of the system. This depression is of an aggravated character—resembling very closely the effects of copious loss of blood—for example, when a portion of a limb has been crushed to jelly by a heavy weight ; when a whole limb has been bruised, scalded, or burned ; when an internal organ, such as the liver, kidney, bowel, lung, or brain, has in any considerable degree sustained lesion ; when an injury, perhaps in itself not very severe, has been done to a frame either originally weak, or enfeebled by intemperance, by previous disease, or by either extremeness of age. In military practice, the importance of bullet-wounds of the trunk is often judged of by the amount of attendant shock ; if depression be slight and transient, the probability is that the wound is but superficial, and at all events that the important internal organs have escaped ; if it be both great and protracted, the prognosis is on the contrary unfavourable, the inference being that the wound has reached a vital part.

The *Symptoms* of nervous shock, after injury, vary from the slightest appreciable lowering of the vital powers, to complete syncope. Ordinarily, the patient falls, and lies helpless, cold, shivering, more or less unconscious, and when roused, probably incoherent ; convulsions may supervene ; the pulse is rapid, small, fluttering, indistinct ; respiration is imperfect and sighing ; nausea and vomiting are common—the latter not unfrequently preceding reaction, and seeming to be concerned in its induction ; a cold sweat bedews the shrunk and pale surface ; the features are collapsed ; the countenance bears a somewhat anxious expression, or else, by entire muscular relaxation, is a vacant death-like blank ; the eyes roll wildly and restlessly, or else are fixed in an upward, listless stare, with the upper eyelid partially closed over the pupil ; often the sphincters are relaxed, fæces and urine seeming to pass involuntarily ; sometimes the secretion from the kidneys is suppressed ; the cerebral

functions may become wholly suspended, the heart's action may cease, and existence terminate.

Sometimes such symptoms abate rapidly, reaction quickly commencing and soon becoming completely established ; sometimes they persist for hours, reaction proving both late and gradual ; not unfrequently reaction fails, sinking is again progressive, the syncope is complete, and life becomes extinct.

Reaction—a more or less gradual return towards health—is usually preceded by a distinct rigor, and very often by full vomiting. The influence of the nervous system is restored, and the sanguiferous proportionally rallies. Sensation, motion, intelligence, gradually return. The patient becomes conscious of his state, and inclines to inquire into it ; his manner grows less wild and agitated, his eye is steady and expressive, his countenance is less anxious, his features are more full and composed ; secretion again becomes normal ; the heart beats with gradually increasing power and regularity ; the pulse becomes stronger and equable, and is felt distinctly in the extremities ; heat comes back to the surface, and this parts with its pale anserine appearance. The patient recovers himself, in short ; sits up ; and once more is an intelligent member of the world around him. This may be the result of Nature's effort, alone and unaided ; or our art may assist in its induction.

Whether its commencement be spontaneous or not, its progress should always be watched most carefully. The action may advance favourably to completion, and proceed no further than attainment to the even balance of health ; little or no extrinsic aid being required, either then or subsequently. Or it may overstep the bounds of health, and pass into disease ; producing either irritative or inflammatory fever, according as the excess is of a sthenic or asthenic character. Or the salutary effort may be imperfect from the first, and asthenic throughout ; partial restoration of pulse, consciousness, and general warmth, being quickly followed by relapse ; a febrile accession occurs, but is of the typhoid character, tending to renewed prostration, collapse, and death. Again, in the case of lesion of certain internal organs, as the brain, premature occurrence of simple reaction may prove calamitous by escape of blood from the injured part—unfavourable to persistence or resumption of healthy function. Even from an ordinary wound, the progress of reaction must be regarded ; otherwise an inconvenient hemorrhage may ensue.

But the shock of injury may be considered practically as of two kinds—*mental* and *corporeal*. In the former, the patient—to use an ordinary phrase—is more frightened than hurt. The wound in reality is but slight, yet the attendant shock is great ; it is however transient. Its origin was mental ; alarm, being great and sudden, exercised a most powerfully depressing influence on the brain and general nervous system, which again lowered the circulation, and the combined result may have been a near approach to syncope. But so soon as the mind has been reassured—the injury having been seen and felt to be in truth trivial—depression passes away, and by reaction the balance of health is soon re-established. The practical importance of distinguishing between this and the more real shock may be thus illustrated.—Suppose a patient

about to undergo an operation, on account of mechanical injury done to a comparatively unimportant part, and plainly labouring under depression of the general vital powers—shivering, pale, cold, breathing rapidly, with an alarmed expression, and almost pulseless. If this state is but of mental origin, the preparations for operation may be continued ; a few words of kindness and comfort, with perhaps a mouthful of wine and water, will probably suffice to establish almost instant reaction. Whereas, if the cause be altogether unconnected with mental impression, the patient may be at once removed from the operating table to bed ; inasmuch as some considerable time must necessarily elapse, ere the system can have recovered itself so far as to possess a tolerance of operation. The one form of shock is in its nature very transient, the other is to a greater or less extent enduring.

There are many cases in which both forms of shock are more or less combined ; as can be readily imagined. For example, a man may be mortally wounded by an unexpected and unseen foe ; the shock of the injury will be great, although entirely corporeal in its origin. A second may receive only a scratch, while he expected nothing but instant death ; the shock will probably be serious, and may indeed amount to actual syncope ; yet it is purely mental. A third may sustain a serious injury, from an assailant both seen and feared ; and the shock will be intense ; mental and corporeal impression both contributing towards the lowering result. In such cases as the last, it is practically useful to ascertain if possible—by inquiry into the history of the accident, and as to the natural temperament of the patient, as well as by carefully noting the existing symptoms—in what proportions the combination has probably occurred.

Treatment of Shock.—In the mental form, as already stated, reassurance and a little time are sufficient to recover the patient ; the application of heat, with some cordial internally, hastening the event, if necessary. In the corporeal, two errors—in their nature very much opposed—require to be guarded against ; premature bleeding, and premature stimulation. A patient having received a fall, is probably found unconscious and incapable of motion ; and the unwary practitioner may mistake such a state for the coma induced by extravasation. A vision of apoplexy, with its wonted remedy of venesection, passes on the instant through his mind ; his lancet, as it were mechanically, leaves its case, and reaches a vein in the bend of the arm, or the jugular vein, or the temporal artery. No blood may follow the incision ; and it is well ; for loss of blood—a most powerful agent of depression—is not likely to prove beneficial when depression is already great and dangerous. By and bye, reaction begins to be established ; the pulse may be felt and counted, the skin becomes warm, and signs of returning consciousness appear ; at this stage, bleeding is not unfrequently practised ; and still it is premature. Nature now, however, is in a state of self-defence ; and but little of the precious fluid escapes ere syncope again occurs, arresting the flow—a protest and a safeguard against the *malapraxis*. The time for bleeding is neither before reaction nor during its early progress ; but after it has been established, and when it threatens to advance to an inflammatory excess.

Again, let us suppose that the case is not one of simple concussion,

but that lesion of the cerebral structure has occurred. Perhaps the shock—for at first the symptoms may be those of concussion only—is of long continuance ; hours may elapse, and yet the circulation is weak, and almost limited to the trunk. This is fortunate ; for, during such a condition, hemorrhage is not likely to take place from the injured texture ; and time is afforded for the completion of that beautiful process, to be afterwards described, by which Nature prevents loss of blood in many cases of injured vessels. Then, when reaction does occur, and activity of circulation is restored to the brain, bringing with it return of function, no open vessels permit sanguineous extravasation ; and coma by compression has been happily prevented. This is a felicitous adaptation of circumstances to the attainment of an important and salutary event ; and let the surgeon look on in passive admiration. But, not unfrequently, he tires of waiting on Nature, and administers stimuli at an early period to bring about reaction ; unfortunately he is successful in his short-sighted aim ; circulation is restored to the torn part, while its vessels are yet open ; concussion is converted into compression ; and danger to life is increased tenfold. Under such circumstances—and they are of common occurrence—early recourse to stimuli is strongly reprehensible. The practice must prove in all such cases prejudicial ; and in not a few it will be certainly fatal.

In the treatment of the shock of injury, then—and more especially when the head is the part injured—early bleeding and immature stimulation are both to be avoided. The injured part receives the mechanical adjustment that is necessary ; and the patient is laid in bed, or elsewhere, as comfortably as possible ; with the head (unless it be the seat of injury) in the first instance rather low, so as to favour return of arterial circulation there. The event is then carefully watched. Reaction may soon occur, without further aid from us, and may require even active means for its moderation. When it is tardy, and there seems to exist no reason why its retardation should be desirable, friction and heat are to be applied to the general surface ; and should these fail, stimuli are then cautiously administered by the mouth—if the patient is able to swallow ; beginning with simple fluids, such as hot tea or soup, and gradually ascending in the scale, if need be, to brandy and ammonia. The exhibition of these requires great care, when insensibility is complete ; otherwise they may get into the air passages instead of into the gullet, and suffocate the patient. In many cases, indeed, we must trust to other means ; such as stimulating enemata of turpentine or brandy ; galvanism ; or the application of powerful stimuli—as sinapisms, hot irons, blisters, strong ammonia—to the surface, with the double object of rousing the spinal system by reflex action, and courting sanguineous circulation towards the part irritated. But in the use of such remedies, again, it is to be remembered that sensation is for the time in abeyance ; and unless we—as it were—feel for the patient, the applications are apt to be unnecessarily severe ; proving very troublesome, and perhaps even dangerous, in their results, after reaction has been established—as by ulceration, sloughing, or extension of superficial inflammatory disease. The ammonia, for example, of a smelling bottle has often been carelessly thrown into the nostrils, producing sad disturbance there. During syncope, the

patient is unaware of this fresh injury ; but, very soon after reaction, the effects of the overdone remedy may largely predominate over those of the original accident. Lives have actually been lost by nasal disease, so induced, having extended to the cranial contents.

The internal use of stimuli must also be conducted with extreme caution, as to their legitimate effects ; being desisted from so soon as circulation is restored satisfactorily ; otherwise, danger by excessive reaction can scarcely be escaped. If inflammatory fever set in, along with local inflammatory change in the injured part, not only are all stimuli scrupulously withheld, but antiphlogistics are administered as circumstances may demand. If, on the other hand, irritative fever be the result, opium or other narcotics, in guarded doses, are indicated. And it is to be borne in mind that when the shock has been severe and protracted—more especially when it has occurred in a frame previously weak—the sthenic period of reaction is apt to be but short ; the tendency is to gangrene locally, with typhous seizure of the system ; and in such cases the more powerful antiphlogistics must be employed sparingly, if at all. When the injury has been attended with great loss of blood, reaction is seldom or never of the sthenic form, but of the purely nervous kind ; and for the assuaging of this, a full opiate is most effectual.

Vomiting usually disappears before ordinary restoratives, along with the other symptoms of shock. Should it prove troublesome—as it sometimes does, with hiccup—it may be directly treated by a sinapism to the epigastric region, with small doses of the spiritus ammoniæ aromaticus. Naphtha, creasote, prussic acid, and ice are also useful. And an enema or suppository of morphia, sufficient to induce somnolence, will frequently succeed in checking this exhausting symptom.

Thus, the dangers of shock after injury are, 1. Continued depression, sinking, and death ; to be met by restoratives ; abstaining from blood-letting, and other sedatives, during the early period of nervous commotion. 2. Immature and excessive reaction, of a sthenic and vascular character ; to be met by blood-letting or other antiphlogistics ; the use of restoratives being of course refrained from. 3. Excessive reaction, probably remote, of a nervous type ; to be met by opiates and other calmatives, cautiously administered. 4. Asphyxia, or other disaster, by the use of stimuli and restoratives ; to be avoided by care, prudence, discretion, and coolness, on the part of the practitioner.

CHAPTER XX.

OF WOUNDS.

THE term Wound need not be defined. It is used in surgery in its ordinary acceptation. Many such injuries are the result of accident; others, of design. They vary in extent and importance; from a mere scratch, to amputation of the hip-joint, or a gunshot laceration which may tear away the half of the thorax. But, indeed, all are important; and the least should never be regarded either as trivial, or as matters connected with a part alone. Those apparently most simple may involve, ultimately, much suffering and danger. Hemorrhage, erysipelas, gangrene, hectic, pyæmia, tetanus may occur; bringing life and limb into the most imminent peril.

Wounds are of different kinds; and, classifying them, we speak of Incised, Subcutaneous, Contused, Lacerated, Punctured, Poisoned, and Gunshot wounds. In examining and describing wounds for forensic purposes, the site, direction, and characters of the wound should be carefully noted, more especially its relation to neighbouring fixed points, and to deeper-seated parts of importance. When the wound has been inflicted through the clothes, the correspondence of the aperture in them with the solution of continuity of the surface should be noticed. The instrument with which the wound is supposed to have been inflicted should be compared with the wound itself, and any stains upon it should be carefully examined, for the purpose of determining whether composed of rust, or due to the presence of blood. The same careful investigation should be made of stains upon the clothes, and the mere fact of its being blood should not alone be decided; but, so far as is reliable, the question of its being human blood should be carefully considered. The best tests for blood are, 1st, Microscopic examination of a portion of the suspected stain, which has been allowed to soak upon a slip of glass in a small quantity of glycerine, for the discovery of corpuscles; 2d, The chemico-micrological detection of crystals of hæmine.*

I. INCISED WOUNDS.

These are inflicted by a sharp-edged, cutting instrument. They are the most simple and favourable kind of injury; being the most capable of speedy union by adhesion, and consequently least liable to inflammatory or other accidents. Their surface is greater than their depth; and they are free from laceration and contusion. Their most prominent symptom, and greatest danger, is hemorrhage, especially arterial.

In the treatment, our first care is to arrest the hemorrhage. Our

* *Vide* Virchow's Cellular Pathology, translated by Chance, p. 145.

second is to remove foreign matter which may be present. The third is to arrange and superintend the wound ; so as to favour the mode of union which, under the particular circumstances of the case, we consider most desirable.

The treatment of wounds has been greatly simplified, and improved, of late years. In the beginning of the seventeenth century, Cæsar Magatus, an Italian surgeon, exerted himself in this way ; and, about a century later, Boccacini warmly supported the practice of his countryman, especially forbidding all greasy or oily applications. But neither of these surgeons seem to have had many followers. And it was not until the middle of the eighteenth century, that our own Percival Pott—abolishing the maxim, “*Dolor medicina doloris* ;” explaining Nature’s powers and mode of healing ; adapting surgical treatment so as to assist these ; discarding the painful and unnatural practices opposed to them, howsoever dignified and guarded by the cloak of antiquity ; and so establishing a system at once more rational and less severe—achieved a most important reform in the practice of his profession. His immediate successor, the great John Hunter, by his valuable expositions of the natural processes in both health and disease, and more particularly of the doctrine of adhesion, confirmed the practical reforms of Pott, and stimulated the profession to cultivate and extend them. The gradual result has been, that, amongst other important improvements in surgery, the treatment of wounds has now become as efficient as it is simple and humane.

Simplicity, however—which may usually be considered an index of the degree of perfection, in almost all surgical proceedings—is of but recent date. Not very long ago, the dressings of wounds, though stripped of pain and cruelty, were unnecessarily numerous and complex, and likewise but ill calculated to forward the object for which they were employed. A routine system had been so long followed, that practitioners seemed never to dream of another. All wounds “were put together without delay ; and their edges, having been squeezed into apposition, were retained so by various means, such as sutures, plasters, compresses, and bandages. They were carefully covered up, and concealed from view, for a certain number of days. Then, the envelopes of cotton and of flannel, the compress cloths, the pledgets of healing ointment, and plasters were taken away ; loaded with putrid exhalations, and with a profusion of bloody, ill-digested, foetid matter. A basin was forthwith held under the injured part, and the exposed and tender surface, having been deluged with water from a sponge, was well squeezed and wiped. Then came a re-application of retentive bandage, of the plaster, of the grease mixed with drying powder, all surmounted by some absorbent stuff, as charpie or tow, to soak up the discharge. This was not unaccompanied with pain—often more complained of than that of the original injury or operation. The process was repeated day after day. The patient was kept in a state of constant excitement ; and often, worn out by suffering, discharge, and hectic fever, he fell a victim to the practice. The system was a bad one—the applications filthy and abominable—the whole proceedings outraged Nature and common sense. The wound was, as it were, put into a forcing bed ; excited action, beyond what was required, was hurried on, and the consequence was that speedy union

seldom, if ever, could or did take place. On the contrary, a suppurating surface was formed, with profuse discharge ; and a very tedious cure, if any, was obtained.”*

Treatment for immediate union and healing by adhesion.—Hemorrhage having been stanchd—and the wound cleansed, gently and carefully, from foreign matter, if need be—coaptation is to be thought of. And a question immediately arises, as to when and how that is to be accomplished. Formerly, as has been already stated, it was the practice to make the coaptation both immediate and complete ; but, now, temporary delay and incompleteness are often deemed expedient. If the external wound be put together while oozing of blood continues, even though slightly, and more particularly if it be covered up by lint and bandaging, adhesion cannot but be thwarted. For, supposing that the bandaging fails instantly to arrest the oozing—as is most likely—the blood, unable to escape, accumulates in a coagulum, which occupies the cavity of the wound ; separating the cut surfaces to a greater or less extent ; and enacting the part of a foreign substance, as effectually as would lint, or charpie. Besides, the coagulum resembles a hot sponge, in contact with the cut vessels ; and as the collateral circulation becomes more and more fully developed, in consequence of deligation of the principal arterial trunks, hemorrhage is most plainly favoured, from vessels which otherwise would have been permanently closed by natural hemostatics. Complete undoing of the coaptating means, exposure of the wound throughout its whole extent, removal of the interposed coagulum, arrest of the hemorrhage, and subsequent reapplication of the dressing, become necessary ; proceedings not only very painful to the patient and irksome to the practitioner, but also most opposed to the occurrence of adhesion ; for a part, so stimulated by fresh manipulation and injury, can scarcely escape inflammatory accession. And even should bleeding not occur to such extent as to demand re-opening of the wound for its arrest, still the mere lodgment of a coagulum forces on the inflammatory process, and suppuration becomes established. Seeking adhesion, it is our object to have no accumulation of clotted blood between the cut surfaces ; to have no necessity arising, by hemorrhage, for re-opening the wound ; and to avoid all exciting causes of the higher inflammatory grades. These indications are fulfilled by delaying all attempts at closure, for some little time, in wounds of moderate extent ; and in those of large dimensions, as after amputation, making the immediate approximation only incomplete. The oozing thus escapes externally, without accumulating within ; means are in operation to arrest it—namely, the application of styptic influence by atmospheric exposure, or by cold irrigation ; and should a vessel prove troublesome, it can still be secured, with comparatively little trouble or pain. In a large wound one or two stitches are applied ; to prevent exposure of the whole raw surface, and to facilitate subsequent approximation. The minor wound are untouched by needle, strap, or bandage. They are loosely covered with a thin portion of lint, wet in cold water ; and, by its means, application of cold is made continuously, either by alternations of such piece of wetted lint, or by irrigation—as thus : Suspending a bottle of col-

* Liston's Practical Surgery, p. 31.

water in a suitable position as regards the part, and “placing in it a few threads of lamp cotton, one extremity of which should reach to the bottom of the bottle, the other hang out at its mouth.” In this way a species of syphon is obtained, with a constant dropping on the lint which invests the part. In warm weather, or in hot climates, ice may be advantageously substituted for water; a large fragment suspended in a canvas bag over the stump or wounded part, and the droppings allowed to run over the surface, will in such circumstances prove grateful to both part and patient. By such treatment, not only is oozing more speedily arrested, and the formation of an interposed coagulum prevented; but, also, nervous and vascular excitement are repressed; consequently, a rise towards inflammatory excess is opposed; and the minor grade of the process, favourable to adhesion, is secured. Besides, the collateral circulation, tending to re-open the smaller arterial orifices, is moderated; and recurrence of bleeding is rendered improbable.

After a time—in some cases a few minutes only suffice—all oozing ceases, and the cut surfaces become of a glazed appearance. Then is the favourable opportunity for effecting complete coaptation; without any foreign substance interposed between the cut surfaces, and with the plastic material of reunion already in process of formation. By longer delay, we should probably incur the risk of undue stimulus, from atmospheric exposure.

If it be objected, that when some considerable time elapses between the infliction of the wound and its final dressing, fresh and unnecessary pain is occasioned—such objection may be sufficiently met by the employment of anæsthesia.

And now the question arises—What is the preferable mode of effecting accurate apposition of the wound? It is not the insertion of numerous, dragging stitches; the application of much impervious and irritating plaster; nor the pressure and heat of pledgets, compresses, and bandage. The object is not to pull, press, heat, hide, and irritate the parts; but simply to retain them in close yet easy contact. The preferable agents of coaptation are, position, and plaster; and, in many wounds, these alone are quite sufficient. But, in others, where there is loss of substance—or when, from any other cause, approximation is not easily effected—sutures are indispensable; otherwise the wound would gape, and could not adhere. Sutures are of different kinds. Those most commonly employed are termed Interrupted. Till of late the needle was armed with thread or silk. Now these are superseded by silver or iron wire—fine and ductile—quite as easy of application, and much less irritant by their lodgment in the part.* The needle so armed is passed through the margins of the wound, so as to include the whole thickness of skin and a portion of areolar tissue; entering and emerging some little way from the margin of the line of incision. The wire is secured by a double knot or twist; with sufficient tightness to make approximation complete at that point, yet not so tightly as to pucker the wound, or bruise the included textures. These sutures are to be as few in number as possible; and, in all cases, their use is temporary. By some, it is

* For this great practical improvement in surgery we are indebted to Dr. Sims of New York.

true, sutures are still wholly trusted to for coaptation. But it ought to be remembered, that the stitching is of living flesh, and not of an inanimate garment; that each suture is a fresh stimulus, prone to excite inflammatory excess; and that if such stimuli be numerous and permanent, in a short space of wound, that evil is all but inevitable. The living structure does not fail to resent the injury to some degree, and resists the lodgment of foreign matter even though metallic. And, further, suppuration of the wound itself, with delay of cure, does not constitute the sole hazard; erysipelas, or diffuse subcutaneous suppuration, may ensue; requiring active and severe treatment, and, even with that, perilling existence.

M. Vidal, in slight wounds, introduced the use of small spring forceps (*Serres fines*), about an inch and a half long, which are provided with three teeth-like hooks at their extremities. They take a firm hold of the skin, without transfixing it, and are said to cause little or no uneasiness. Retained for eight or ten hours, the wound may have by that time adhered with sufficient firmness, to render all extrinsic retentive means unnecessary.

As already stated, position and plaster are the preferable agents of apposition. The part is placed, comfortably yet securely, so as to relax those muscles whose fibres, on the stretch, would naturally im-



Fig. 199.



Fig. 200.

pede the object in view. The surrounding skin having been gently freed from hair and moisture, the edges of the wound are carefully and gradually opposed accurately to each other, by the hands of an assistant; who retains them so, while the surgeon applies strips of adhesive plaster over the line of wound. The preferable kind of plaster is that brought into use by Mr. Liston; consisting of a strong solution of isinglass in spirit spread evenly upon oiled silk, or upon fine animal membrane, or upon silk gauze. The gauze is probably the best; first made waterproof by a coating of boiled oil, and then laid over with layers of the dissolved isinglass. The advantages of this kind of plaster are, that it does not irritate, while yet it adheres with much tenacity; not tending to encourage erysipelas, or inflammatory excess of any kind; and entailing no trouble to the surgeon, pain to the patient, or injury to the part, by frequent renewal. Often the first application remains firm throughout the whole period of cure. Another obvious and important advantage is that the plaster, being translucent, permits a surveillance of the whole track of wound; as complete as if no dressing whatever had been employed. The slips should be long; in order that, enacting the part of

Fig. 199. Suture needle; with improved point, *a*. *b*, Needle in fixed handle useful in tying erectile and other tumours.

Fig. 200. The common interrupted suture. The knots not tightened.

bandage, they may support the whole wound, and prevent falling away of the cut surfaces in the deep as well as in the superficial portion ; this being most especially necessary in large flap wounds, as after amputation. And this indication may be further fulfilled, while at the same time the main straps are rendered more secure, by one or two slips being placed round the limb, so as to overlap the extremities of the former. Interstices should be left between each of these ; in order to permit free escape of the slight serous discharge, which oozes out during the process of adhesion. And, if sutures have been employed, these are left uncovered also ; in order to facilitate their subsequent removal. When, after some hours, the plaster has become consolidated, the sutures may in some cases be dispensed with ; in whole, or in part. If there have been a laxity of integument, with facility of apposition, they may be all gently removed by section and withdrawal of each noose ; but if there have been, and still is, some straining on the part, removal of the sutures should as yet be but partial, or altogether deferred. It being at all times borne in mind, however, that the sooner they are taken away—without displacement of the wound—the more likely is adhesion.

When the process advances favourably under this treatment—as it will do in the majority of cases in which it can reasonably be expected—no other applications are required. All that is necessary has already been done ; the wound is approximated, and retained so, under favourable circumstances ; and further covering of it would only tend to thwart the occurrence which it is our wish to promote. All pledgets, cloths, and bandages, are therefore not to be thought of. It is sufficient to wipe away, as often as is necessary, the fluid which may exude from the dependent part of the wound. Thus, attention to cleanliness becomes the principal duty of the dresser in the after part of the cure ; and, to facilitate the performance of this duty, the wounded part when extensive, as after amputation, is placed on a pillow covered with a sufficient portion of oiled cloth, from which the secretion that trickles down can be wiped away without any soiling of the bed linen. It is scarcely necessary to add, that there should be no washing or scrubbing, of either the wound or its immediate neighbourhood.

In one class of cases, lint compresses with bandaging may be necessary at the time of coaptation ; namely, those in which it is not in our power to ensure otherwise the accurate adjustment of the deep wound—as after some amputations and dissections of tumours. When their work is done, however, in keeping the flaps together and preventing accumulation of blood, the sooner they are removed the better.

In slight and superficial wounds, collodion is an excellent means of retention ; applied either continuously over the part, so as to make one unbroken covering ; or, what is better, put on in strips across, like plaster, by means of a stroma of lint.

Towards the end of the cure it often happens, in large wounds, that more or less cedematous swelling takes place in the edges and the surrounding parts ; after amputation, for example, this is by no means an unfrequent occurrence. To remove this, a plain bandage is necessary ; lightly and uniformly applied, so as merely to support the parts ; favouring absorption and venous return, without occasioning pressure or irrita-

tion. And this is the only addition to the simple treatment by plaster, that is likely to become either expedient or necessary when adhesion is the mode of healing.

So far the manipulations of surgery are concerned. But the constitutional treatment is equally necessary; rest, quietude, and antiphlogistic regimen. The last indication is especially important; and yet is often either disregarded or inefficiently fulfilled. In an approximated wound, inflammatory excess is the great enemy of adhesion; and, unless regimen be kept of the most sparing kind, it can hardly be avoided. Immediately after infliction of the injury, the patient should receive little or nothing in the way of sustenance; and all hot or otherwise stimulating fluids should certainly be prohibited; otherwise, hemorrhage by reaction is favoured. And, subsequently, both food and drink should be kept on the truly antiphlogistic scale; so long as there is a wish for adhesion, and a probability of its occurrence. Probably, if this dietetic part of the treatment of wounds were more carefully attended to, the occurrence of adhesion would be proportionally more frequent.

At the same time it is to be understood, that the principle may be carried too far. Both irritation and prostration of system must be avoided. Only during the first few days is starvation essential, while adhesion is yet probable. That having been attained, a gradual transition is made into more generous regimen. Or, adhesion having failed, a similar transition is equally necessary, after the inflammatory crisis has been passed by. Be it remembered also, that after severe operations, antiphlogistic regimen ought always to be conducted with the greatest caution; for it is probable that a tedious cure, by granulation, may eventually tax the powers of the system to the utmost. And further, much must necessarily depend on the previous health and habits of the patient.

A short time is sufficient for the establishment of adhesion. If it is to occur at all, it is certain within a week; three or four days ordinarily suffice. The cut margins are consolidated, the one with the other; the line of wound is dry, and invested by a thin crust. If some of the sutures have not been previously removed, they should now be taken away; their occupation is gone; their further presence will but invite suppuration and ulceration in the immediate vicinity of each noose—Nature's invariable effort for the extrusion of the foreign substance; and if such inflammatory excess spread, adhesion will be undone, and the wound will gape as at first.

When wire sutures, however, are employed, there is neither the same degree of irritation created, nor the same necessity for early removal of the sutures, unless indeed by original closeness of application they prevent the escape of fluid from the deeper part of the wound. Sometimes the wire sutures may be allowed to remain throughout the whole process of union, even when this has been a slow process; thus avoiding the necessity for the application from time to time of plasters, and saving the patient much pain which would otherwise have been incurred from daily dressing. During the period while union of the wound, in whole or in part, by adhesion may reasonably be anticipated to be in progress, the less movement of the part, either by the patient or by the

too anxious or meddlesome surgeon, the greater is the probability of the desired result.

Parts which have been wholly severed from the body—as portions of fingers, of the nose, of the ears, etc.—have been readjusted with success. Under favourable circumstances, reapplication may be made very carefully; retention being secured by suture and plaster, and the treatment conducted for adhesion. But the part is more likely to slough than to live; and, when it does adhere, sensation often returns in a perverted form, causing much uneasiness.

Treatment for Granulation.—If adhesion fail, suppuration becomes established. The margins of the wound swell, redden, become painful, and tend to separate from each other; while from the chasm a more or less copious purulent secretion is discharged. Nothing can be worse in surgery—as a general rule—than the retention of sutures which constrict the parts or confine the discharge. The wound, by swelling, tends to open; but is thwarted by mechanical means. Pus is formed, often copiously, and should be discharged freely; but this, by a mechanical and perverse shutting of the wound's mouth, is prevented. The parts are inflamed, and it is our object to moderate the attack—knowing well that until that has subsided, the process of healing cannot be begun; but the continued stimulus of the strained sutures maintains and aggravates the untoward process. After a time, the noose ulcerates its own way out, and the part is relieved; but, ere this, much injury—local and constitutional—may have been sustained. Sometimes, however, sutures are retained for their merely physical effect; though there be no chance of adhesion, and though the suppurating line of wound may be struggling to be free. In the operation for reclaiming simple fungus of the testicle, for example, sutures are so used; otherwise, during the granulating process by which the wound generally heals, at least in part, the fungus would spring upwards and again project—retarding or even frustrating the cure. And so there are exceptions to the rule.

While all sutures which confine discharge in a suppurating wound are in general not only useless but injurious, and ought to be removed, the plasters may be allowed to remain. They yield a little, so as to permit the due amount of opening in the wound; yet still they retain an approximating power, and prevent undue resilience of the edges. They are not only left undisturbed, but, when loosened by the discharge, may be renewed. The secretion is wiped up frequently; but no absorbing dressing is required; pledgets, compresses, and bandages, only heat and irritate the part, and determine suppuration. If anything be applied, light and simple water-dressing is enough; of no greater extent than is sufficient to cover the line of wound. After a time, this dressing is medicated by some gentle stimulant, as the zinc or red lotion; and, if need be, bandaging is employed.

There are many wounds, either altogether incapable of adhesion, or in which it is not to be expected. Those, for example, with loss of substance, which cannot be approximated; and those which, from lodgment of foreign matter, or other cause, can scarcely fail to suppurate. In such, the treatment is precisely similar to that recommended for abscess, after incision, and in the management of the simple suppurating ulcer. Here,

the use of sutures is never expedient—with such exception as has already been stated ; it is worse than folly to drag and retain parts in contact, which cannot adhere, and which must inflame and separate. We never attempt to make the coaptation complete ; we would not have it so, were it in our power. The parts are simply replaced, and retained, as nearly as possible in their natural situation, by careful attention to position. In some cases, a strip or two of plaster may be useful ; as when a flap is loose, and threatens to be pendulous. Then the water-dressing is applied ; at first cold, to suppress oozing ; afterwards tepid, to prove comfortable to the part, and yet not to favour return of bleeding. As the inflammatory process sets in, after some hours, it is gradually made hot, and frequently renewed ; in order to moderate the process, relax the part, and favour secretion. As the inflammatory process subsides—usually in a day or two—the temperature is diminished, until the dressing is simply protective and detergent ; to continue a high temperature then, would be to encourage the untowardly relaxing and congestive effects formerly spoken of. Should the granulating sore begin to evince symptoms of deficient power, the dressing is medicated, stimulant, in the ordinary way.

Uniform support by bandaging, when suitable to the form of the part, is usually expedient in these cases, from a comparatively early period. It must always, however, be employed with caution. If pressure be had recourse to unnecessarily, if it be partially and unequally applied, if it be of undue severity, or if its use be unnecessarily prolonged, inflammatory mischief cannot fail to ensue—in any wound.

In some cases, the inflammatory process, proving excessive, may cause sloughing around the wound ; thereby untowardly enlarging its extent, and protracting the cure. To avert this, more active antiphlogistics may sometimes be required ; abstraction of blood from the part, and, it may be, from the system also ; along with other ordinary antiphlogistic means.

Constitutional treatment, so long as the inflammatory stage persists, is antiphlogistic ; proportioned in severity to the amount and kind of the affection. Towards the latter part of the cure, when suppuration is profuse, and contraction slow, a generous regimen becomes expedient ; and even powerful tonics and stimuli may be required.

Sometimes the case may be so managed, that adhesion is ingrafted on granulation. For example, in deep suppurating wounds (as after amputation), which, by fulness of their edges, admit of complete and easy approximation, water-dressing may be discontinued under certain circumstances, and plasters applied in the same manner as recommended for adhesion. This fortunate period is, when the inflammatory process has receded so far as to be merely sufficient for the formation of healthy granulations. At this time, the discharge is in very small quantity ; and the divided surfaces are almost as prone to coalesce, firmly and permanently, as in the glazed condition, formerly spoken of, which occurs soon after cessation of the immediate hemorrhage. Consequently, when the watchful surgeon seizes upon this opportunity, and, discontinuing his second-intention treatment, places and retains the parts in close and accurate apposition, it is more than probable that cohesion will then

take place, speedily and effectually, by amalgamation of the granulating surfaces. If it fail, there is merely the trouble of removing or relaxing the retaining plasters ; resuming the treatment by water-dressing.

In the healing of all wounds, whether by the first or second intention, the importance of absolute rest of the injured part is very obvious. Without this, the reparative process must be constantly liable to interruption. It may have been most favourably commenced ; Nature may seem most anxious to complete it ; and yet all her best-intentioned efforts may be frustrated by negligent permission of movement. Motion of the body is often both requisite and allowable, for maintaining the general health, and may thus contribute somewhat to the cure ; but all movement of the part itself is most prejudicial, and must be guarded against by every means in our power. Muscles must be kept relaxed and quiet ; joints must be placed in a comfortable and convenient attitude, and retained so. And, to effect this latter object, it may sometimes be necessary to apply splints ; so arranged as neither to make undue pressure on any injured part, nor interfere with the dressing and inspection of the wound. When this is so situated as to be under the bed-clothes, it is, of course, protected by a suitable cradle from their contact and pressure.

Treatment suitable to the mode of healing under a Scab or Crust.—The principles of such treatment are very simple ; but they are of comparatively limited application. They need be attempted only in wounds of slight extent, and in patients of no inflammatory tendency. In all wounds which can be approximated completely, adhesion is preferable ; not as forming a more efficient cicatrix, but as less liable to fail, and lapse into suppuration.

The manual part of the treatment mainly consists in protecting the raw surface from atmospheric influence. Nature may effect this, by a crust of her own. And we may imitate this incrustation, in various ways ; coagulating the juices on the part by a light application of the nitrate of silver ; soaking a piece of lint, little larger than the wound, in the oozing blood, and permitting it to dry and harden on the part ; laying on goldbeater's skin ; evaporating collodion on a stroma of lint or charpie ; overlaying the part with a solution of gutta-percha in chloroform ; or employing tepid water-dressing, and renewing it seldom if at all. The collodion forms an admirable thatch ; but it has one objection, namely, causing pain and stimulus in application. Instead, a thick semifluid aqueous solution of gum tragacanth may be used. It is laid gently and uniformly on the raw surface, so as completely to protect it ; and if at any portion the envelope threaten to become imperfect, the attendant is directed to effect an immediate repair. The application is productive of no irritation ; and, being translucent, permits a complete surveillance of the part. Atmospheric influence is completely excluded ; and the raw surface would seem to be placed in circumstances somewhat analagous to its normal state, as if still invested by the integument. Should the inflammatory process ensue, notwithstanding, no harm has been done ; on the contrary, this is likely to prove less intense than it otherwise would have been ; the gum is loosened and washed away by

the purulent secretion ; and water-dressing may then be used, as in ordinary circumstances.

The constitutional treatment is antiphlogistic ; rigidly enforced. In short, our object is to avoid all stimulus, both local and constitutional ; and thereby to prevent the inflammatory access.

Such are the means whereby the different modes of cure may be favoured. Nothing is actually done by surgery itself ; our art must rest contented with assisting, or at most directing, the workings of Nature. To the general rules there are found exceptions ; as might naturally have been expected.

The most prominent of these, is the use of *Twisted suture* ; especially suitable to some wounds of the face ; as for the cure of harelip. Here the rule of delay, previous to coaptation, is transgressed ; and with impunity. Also the sutures are permitted to remain until adhesion has been supposed complete. A needle—a common sewing needle, or one made for the purpose with a flat steel point—is made to transfix the margins of the wound ; and is retained. Around it a portion of fine silver wire, or of waxed thread, is passed in the form of the figure 8 ; and by this, the wound's margins are brought and retained in contact. Each needle has its own wire or ligature ; for if union or community of these be attempted, puckering of the edges is very likely to follow. In such a wound as that for harelip, two points of this suture usually suffice. At the end of two or three days, one needle is removed ; on the day after, the second is also gently loosened and taken away. But the twisted wires or threads, if adherent and protective, may be left undisturbed.

Such wounds, whose superficial extent may vary, but whose depth is limited, admit of being retained in close and accurate contact at every point ; so as to prevent the interposition of coagulated blood, or other obstacles to adhesion. Accordingly we find, that when they are brought together at once by the twisted suture, neatly and carefully applied, and when the needles are cautiously removed as early as prudence will allow, adhesion scarcely ever fails to occur. But if—in addition to the points of suture—plasters, pledgets, or other dressings be applied, the rule again becomes absolute that multiplicity of investments are inimical to adhesion ; the wound will suppurate at one or more points, or throughout even its whole extent.

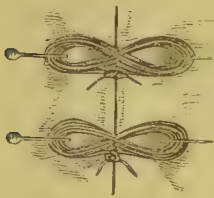


Fig. 201.



Fig. 202.

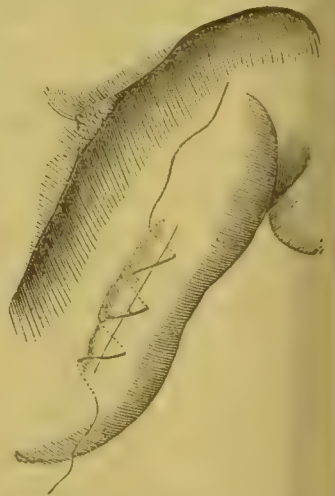


Fig. 203.

Fig. 201. The twisted suture.

Fig. 202. The quilled suture. The dotted lines mark the course of the wire beneath the integument.

Fig. 203. The glovers', or continued suture ; in wound of the bowel.

In some situations, as about the nose, neither plasters nor the twisted suture can be used as retentive means. Then, as few points as possible of the common interrupted suture are to be inserted ; and they should all be cut out, so soon as the progress of adhesion has rendered their retentive influence no longer absolutely necessary. Now-a-days, indeed, the common metallic stitches often supersede the twisted suture, even in harelip.

There are certain wounds—as in the case of lacerated perineum—in regard to which often the *Quilled suture* is the preferable means of retention. And, indeed, in any part, the circumstances of a wound may make recourse to this form of suture expedient. For the whole tract is, in every point, placed and maintained in accurate contact. Metallic ligatures are passed, as in the interrupted suture ; but instead of being secured in the ordinary way, the ends on each side of the wound are tied on a quill or portion of bougie, which is thus made to press the parts into apposition. The wire suture without the quill has, however, been found more manageable and quite as effectual in the treatment of many wounds in which the quilled suture was formerly deemed indispensable.

The *Continued*, or *Glovers' suture*, is made by a fine needle, as if on a piece of linen. It is seldom employed but in the case of slight wound of the intestine.

Other instances of wound, in which the general rules of treatment must be either varied or transgressed, will occasionally occur in practice ; and the peculiar circumstances of each case will regulate the surgeon as to the treatment to be adopted. But even to them this general rule will be found applicable :—The less their management varies from the principles inculcated in the preceding pages—more particularly the all-important maxim of simplicity—the more likely will it be to prove suitable and efficient.

On wounds made designedly, for Surgical ends, the principles of cure have an important bearing. In the great majority of cases, it is our object that the wound shall heal in the most favourable way—by adhesion. Accordingly, the wound should be planned and made so as most to favour that occurrence. The knife used should have a keen edge, and be worked with little pressure ; cutting with a sawing motion, rather than with a thrust ; the object being to make a clean and smooth cut, devoid of bruise or laceration. Neither is the cut to be made across the muscular fibres, but in a line parallel with their course ; otherwise the wound will gape, and, even with force, approximation of the edges may be uncertain. By following the contrary practice, on the other hand, mere relaxation of the part will often be sufficient for the requisite apposition. When the incisions are made for removal of a diseased or injured part of the body, we endeavour to save as much of the external parts, more especially of the integument, as will admit of easy closure or the chasm. And, when the wound is deep, we make its external part more extensive than the internal ; in order that the secretions, which must form to a greater or less extent, may have free exit ; so avoiding retention of these, separation of the wound's edges, obstruction of the adhesive process, and consequent inflammatory accession and suppuration.

II. SUBCUTANEOUS WOUNDS

Belong to the class of incisions, but are peculiar in their mode of production. They are designedly made, by the surgeon, with some curative object in view. Their paramount principle is thorough exclusion of atmospheric exposure from the cut textures. By the absence of such stimulus the mischievous results of the inflammatory process are avoided, union occurring by immediate adhesion, without the formation of any purulent product. A narrow knife with sharp cutting edge is introduced obliquely beneath the integument, at a little distance from the tendonous



Fig. 204.

or other texture to be incised. When it has been passed over or beneath the part to be divided, the cutting edge is directed against it, and the necessary section effected as the blade is again withdrawn. As the knife makes its exit, the track of the blade is compressed with the finger of the Surgeon, or an assistant, to prevent blood occupying the cavity; and the orifice is also carefully closed by pressure, to prevent the entrance of air. A pad of lint of suitable size is then laid on instead of the finger, to effect a like support of the wound and its aperture; and is retained there by means of a strip of adhesive plaster, or a bandage, or both, as may seem best suited for the situation. Furthermore, the part must be kept at rest, by splints or otherwise, so as to permit the process of agglutination in the deep wound to occur undisturbedly; and suitable constitutional treatment is maintained, to secure immunity from the inflammatory access. If blood collects in the deeper part of the wound, it should be carefully squeezed out before applying the pad of lint; as the clot of blood, although not so injurious in a subcutaneous as in an open wound, interferes with the perfection of the process of union.

Accidental wounds often penetrate beneath the skin to a considerable extent. These rarely follow the course of subcutaneous wounds, surgically inflicted; but being more or less lacerated in character, are denominated punctured wounds, the peculiarities of which we shall have to consider immediately.

III. CONTUSED AND LACERATED WOUNDS.

These, closely resembling each other in their nature, and in the treatment required, need not be considered separately. They are inflicted by a blunt body, forcibly applied; or by powerful divellent force. In the one case, the margins of the wound are bruised; in the other they are torn, and of a ragged appearance. Such wounds may be attended with comparatively little hemorrhage and pain; but they are no the less formidable on that account. The lacerated artery, it will be remembered, accomplishes its own hemostatics with rapidity and ease.

Fig. 204. Tenotomy knife, narrow blade, single cutting edge; suited for making subcutaneous divisions.

and when much bruising or tearing has occurred, there is depression of the nervous as well as of all other vital function, and consequently but little sensation of pain. Were it to be imagined that, because a wound is neither painful nor inclined to bleed, it must be trivial, many and serious errors of diagnosis and prognosis would result.

Adhesion is impossible ; inflammatory advance to suppuration is certain. In the greater number of cases, the bruising and tearing are such as either to kill a portion of the implicated texture outright, or so far to diminish its vital power as to render its speedy demission of life inevitable. That dead part must be thrown off, according to the general law ; and, however slight the slough may be, its detachment cannot be effected without suppuration and ulceration. In severe cases, there is a double risk connected with the accession of gangrene. Not only will there be loss of substance by the immediate sloughing ; entailing much suppuration, risk by hectic, and tedious cure. But, besides, the gangrene may spread ; either so as to invade and destroy a large extent of surface—enhancing the dangers just mentioned ; or, involving the whole limb, it will throw the system into intense fever with prostration, and demand amputation—at the least.

Treatment is twofold in its object ; to limit the inflammatory accidents, and to favour granulation in the manner already described. The water-dressing is at first cool ; so as to arrest bleeding, and yet not increase the risk from sloughing by still farther depressing the vitality of the parts ; afterwards it is hot, and conducted in the usual way. Often a large, soft, simple poultice, frequently renewed, is found very soothing to the part, during the inflammatory stage. In severe cases, much judgment is required to regulate the antiphlogistic means ; and this is more especially necessary in regard to abstraction of blood, from the part and from the system. On the one hand, we must be sufficiently active, to check an untoward amount and intensity of the inflammatory process, and so to limit loss of substance and constitutional disorder from extensive sloughing. On the other hand, we must be careful not to lower the system too far ; remembering that suppuration, hectic, and it may be typhoid symptoms, are yet to come. Sutures are in no case necessary, and ought not to be applied ; sufficiency of apposition is effected by replacement, attention to position, and the adhesive slips, if need be. During separation of the sloughs, hemorrhage may occur ; the process, therefore, has to be watched anxiously. Should abscess form in the neighbourhood, or diffuse suppuration threaten, free incision should be practised early.

It is to be remembered, however, that all wounds inflicted by a blunt instrument are not necessarily of this third class. In some cases, they belong rather to the first ; and require the same treatment. When an obtuse body, as a stick, stone, or bar of iron, is brought with smart violence in contact with integument placed over a resisting bone (as on the cranium), an apparently incised wound is not unfrequently the result ; the same in appearance and general character, as if inflicted leisurely by a knife. No doubt, the parts must be to a certain extent bruised ; yet the bruise is not shewn at the time, and may never be evinced at all—healing taking place readily enough by the first inten-

tion. The wound is partly incised, partly contused ; but it partakes much more of the former than of the latter character ; and is to be treated accordingly—by close apposition, and with a view to adhesion.

IV. PUNCTURED WOUNDS.

These are inflicted by the penetration of a sharp and pointed instrument, which bruises and tears as well as cuts. This class of wound, consequently, is of a compound nature. When of any considerable extent, the injury is always serious. A long track of superficial wound, involving little more than the integument and areolar tissue, is comparatively trivial ; when, however, the direction is not along the surface, but towards the interior, there is always reason for apprehension. The danger is twofold :—First, from injury done to important parts ; as arteries, veins, nerves, canals, cavities, joints. Secondly, from inflammatory change occurring in the deep part of the wound, the purulent secretion being confined, diffuse infiltration being consequently favoured, and much damage resulting to both part and system. The form of the wound renders the former danger probable. Its nature disposes to the latter ; for, being in part both contused and lacerated, a certain amount of suppuration is sure to result ; especially in those cases in which blood has been infiltrated into the areolar tissue, in consequence of the form of the wound preventing its free exit. A third danger may be stated ; from the chance of a part of the weapon breaking off, and remaining lodged in the depths of the wound ; rendering inflammatory accession there, and that of an intense character, inevitable.

Treatment.—At one time it was the invariable custom of the surgeon, so soon as satisfied that a wound was of the punctured kind, to dilate it freely ; so as to give it an undoubted title to the appellation of incised. By others, tents or tubes were kept in the wound ; and while active general antiphlogistics were required to moderate the irritation thus induced, it was thought that the patient was really benefited by such procedures. Such unnecessary severity, however, has now been justly abandoned. Dilatation may be required ; but often it is neither necessary nor expedient, in the first instance. The use of tents and tubes can under no circumstances be necessary. A large number of punctured wounds partake of the incised character, more largely than of the bruised and lacerated ; and are to be treated accordingly. By inquiry into the history of the case, examination of the inflicting weapon, and the gentlest possible examination with the finger, if need be, it is ascertained that no foreign matter has lodged. Apposition is then effected, gently and accurately ; by attention to position, and by the use of pads of lint and a bandage to support the track of the wound, and keep its walls in apposition. The part is kept at rest ; and the system is placed under the antiphlogistic regimen. We hope for adhesion, and frequently are not disappointed. Yet it is not unlikely to fail, for the reasons already stated. When it does, transition is made to warm water-dressing, and other means suitable for mitigating the coming inflammatory attack. If this prove moderate, the discharge have free exit, and no

swelling or hardness form deeply, there is yet no demand for dilatation. The ordinary treatment for granulation is carried out; and by granulation the aperture in due time closes, the wound healing from the bottom like a sinus.

Dilatation, however, may be most necessary under certain circumstances. 1. Hemorrhage may be serious, from a divided or punctured artery; and pressure either may have failed, or may seem unsuitable. In the original state of the wound, deligation is impracticable; yet the ligature must be applied. By incision, accordingly, the bleeding point is to be exposed; so as to admit of deligation being easily and securely performed. 2. A portion of the weapon, which inflicted the wound, may remain firmly imbedded in the deepest part. It may be necessary to dilate, to a certain extent, so as to permit the application of forceps, or other instruments, for extraction. 3. When, by deeply-seated suppuration, diffuse infiltration is threatened (as indicated by deep pain and hardness, swelling of the whole of the textures related to the wound, redness of the integuments, and violent constitutional disturbance), free incision cannot be too early employed. Then dilatation is essential to save structure, and to moderate serious disorder of the system. When fascia, or other tendinous texture, has been involved in diffuse suppuration, the case proves peculiarly troublesome, as can readily be imagined, and urgently demands local treatment. The knife must be used freely; and for this purpose the probe-pointed bistoury will generally be found most suitable. The wound should at first be dilated only to the depth of the fascia, especially if it penetrate among important parts which must not be injured; the finger is then introduced as a guide, and, feeling its way, the knife carried along its surface divides the tissues to the requisite extent in a safe direction.

V. POISONED WOUNDS.

By the experiments of Blake and others, it seems fully established that the virus, whatever its nature, pervades the system through the blood; thence re-acting injuriously on the nervous system, and interfering more or less with all the functions of life. The effects are never instantaneous. A certain number of seconds (not less than nine) are requisite for absorption, even of the most deadly poisons. Some of the more intense, as that of the most venomous serpents, would seem also to have a direct influence on the nervous centres; probably by contact of the poison with the nerves of the part injured. Certain it is, that the nearer the wounded part is to the brain, the more speedily are the untoward symptoms developed. But, even admitting that this direct nervous implication is true, it can only obtain to a comparatively slight extent; and we are still forced to hold that the main agent of diffusion through the system is the circulating blood. For it seems established, at least in the majority of cases, that the contact of poison with the surface of the body is not sufficient to give rise to general symptoms so long as its general diffusion throughout the body, by the circulation, is prevented. It does not follow that the virus, when so diffused, shall affect all parts,

in their functions, to an equal degree. On the contrary, it is found that certain tissues suffer in an especial manner; the nervous, pre-eminently.

When a virus has been introduced into the system, and is not speedily thereafter extruded by elimination, it has been supposed that a process takes place in the blood, somewhat analogous to fermentation, and hence termed *Zymosis*; whereby the whole circulating fluid is deteriorated, and the poison at the same time multiplied, perhaps to a great extent. And, according to the poison, this process varies much as to the time which is requisite for its completion.

Some poisons, of much virulence, produce their deleterious, and perhaps fatal, effects very speedily—so soon as introduced by the blood into the system; as happens in the bites of the most venomous snakes. Others, again, do not exhibit their results until the process of *zymosis* has been tardily completed; as in hydrophobia.

A third class of poisons—the syphilitic, for example—seem to have a doubly zymotic character. At first, the part is inoculated; and there the poison accumulates, by *zymosis*; forming the characteristic sore. Thence, too, the system becomes contaminated, through absorption; and in the blood, or organs by which it is prepared, a second, or general zymotic process is effected, whence the secondary symptoms are produced.

The local effect of some inoculated poisons is to produce an intense but asthenic inflammatory process in the injured parts; running rapidly on to diffuse infiltration of unhealthy pus, spreading fast and far, accompanied with much swelling and livid discoloration, and often ending soon in gangrene. Often there is a further complication by inflammatory affection of the lymphatics and veins. And, altogether, a state of matters is established which was formerly not inaptly termed *Cellulitis Venenata*. Gangrene having ceased, and sloughs separated, a deep, troublesome, unhealthy sore remains.

Poisoned Wounds by Dissection.

Here the deleterious virus may be animal; engendered in the body previous to death, and as yet not altered by decomposition; as putrefaction advances, its virulence seems to be destroyed. This form is encountered in the dissection of females who have died from puerperal disease, for example; and inoculation with such a poison is a very formidable accident. Or the virus is the result of ordinary putrescence; and the inoculation of this is an infinitely more common occurrence. In either case the injurious consequences are manifested both in the part and in the system.

I. LOCAL.—These, again, are either simple or severe. 1. *Simple*. A part is punctured, usually the finger; by a scalpel, needle, hook, saw, or projection of bone. The more ragged the puncture, and the less the bleeding from it, the more likely is the virus to lay hold of the part and be absorbed. After some hours the inflammatory process sets in and a pustule forms at or near the puncture. The pustule gives way, discharging a thin, unhealthy, puriform fluid, and degenerates into an acute and

painful ulcer. A minor amount of the inflammatory process involves the integuments around, which are red, hot, painful, and slightly swollen; and not unfrequently this, spreading, establishes an erythema or simple erysipelas. This is the most common form of accident;—in former times, when preservative fluids were not used in injecting the dead body, of almost daily occurrence in those attending the dissecting room.

Sometimes a violent form of deep whitlow is induced; requiring incision to prevent disorganization of texture. Sometimes secondary abscess collects in the axilla; of a chronic kind, without apparent affection of the intervening lymphatics. Sometimes no acute affection occurs at the site of injury; but chronic induration forms there, and is of long continuance.

2. *Severe*.—The inflammatory process is diffuse from the first, and pustular formation at the injured part may or may not occur. A genuine phlegmonous erysipelas or paronychia is established. And not unfrequently angeioleucitis plainly co-exists; evinced by red streaks, very painful, stretching continuously up the arm from the erysipelatous part; or by acute enlargement of the supra-trochlear gland or of the lymphatics in the axilla, connected with isolated patches of inflaming lymphatics on the inside of the limb. Abscess usually forms in affected glands, very speedily; perhaps accompanied with diffuse suppuration of the surrounding areolar tissue. The latter casualty often occurs, also, in the areolar tissue on the corresponding side of the chest. Sometimes the first symptom which attracts the patient's attention is an intense pain in the shoulder; soon followed by glandular enlargement in the axilla, while yet the changes at the injured part are comparatively unimportant. When such is the case, diffuse infiltration of the corresponding side is seldom absent, and usually extensive. And such local disasters, it can readily be understood, are invariably accompanied with intense constitutional disturbance.

II. GENERAL.—1. Derangement of the general health, without local injury, is not unfrequent; poison entering the system by the skin, or by the lungs. This deleterious matter would seem also to be of two kinds; generated in the body before death, as in fever, and encountered in subjects recently dead; or the gaseous product of ordinary putrescence, emitted by any body much decomposed. From either form the student seldom suffers, unless he be either very much exposed to the contagion by long and habitual stay in the dissecting room, or predisposed in consequence of previous disorder of the system. He feels feverish, languid, listless, and without appetite; the bowels become irregular, and diarrhœa sets in, accompanied with much flatulence; the gaseous product of the stomach and intestines is very foetid, the fœtor closely resembling that of the dead body whence the deleterious influence has proceeded; and the same odour is also usually perceived in the mouth, in the breath, in the exhalations from the skin, and in the urine. The system seems saturated with the poison, and busy in freeing itself by elimination. After diarrhœa has continued for some time, perhaps accompanied with profuse perspiration at night, the symptoms usually abate; the greater part of the deleterious matter has been extruded, and the system rallies; unless

the same cause be still in operation, through imprudent continuance in the dissecting room.

2. Constitutional symptoms of the gravest kind attend on the severe local affection ; sometimes antecedent, sometimes consequent ; most frequently the former, and becoming aggravated as the local affection is developed. The first admonition of mischief, beyond slight itching uneasiness in the wound, may be a sense of chilliness, or even severe rigors, which is rapidly followed by febrile disturbance of a simple kind. As the local changes form, the fever assumes the inflammatory type ; but that usually is of short duration ; and is merged in constitutional irritation of a very low kind, tending urgently towards typhoid prostration. In the minor local affection—pustule and erythema—the febrile disturbance is but slight and simple. But in the more severe form—consisting of angeiolecitis, glandular abscess, and diffuse subcutaneous infiltration, often complicated by erysipelas, and perhaps with phlebitis—the general symptoms are from the first of a most alarming nature, and place life in imminent peril. In some few cases, the precursory fever has been so intense, and yet of so low a type, as to carry off the patient even before full development of the local disorder ; as if by direct poisoning.

Treatment. 1. *For the local symptoms.*—Prevention is in our power, and ought never to be neglected. A wound, scratch, or puncture, however slight, having been received in the dissection of a body in which no disinfecting injection has been employed, the part should be immediately washed, and well sucked by the mouth ; which latter operation has the doubly beneficial effect of both taking away virus, and preventing the absorption of any small quantity which may for a time lurk in the part. At the same time, enlargement of the wound may be expedient. If it have been inflicted by the scalpel, and already shew an inclination to bleed (increased by suction), it need not be interfered with. But if it be a ragged scratch or puncture, from a pointed and edgeless substance, as a spiculum of bone, it is well to dilate it slightly by the point of a clean lancet or scalpel ; so as to encourage the flow of blood, and thereby favour the washing away of deleterious matter. After, by washing, suction, and bleeding, a sufficient cleansing has been effected, the part should be lightly touched with the nitrate of silver ; with two objects in view. The nitrate is supposed capable of effecting decomposition of any virus which may remain imbedded in the wounded part ; and we know that it is most efficient in forming a protective crust, whereby the imbibition of other virus may be prevented. To fulfil more completely the latter indication, however, a piece of plaster—or collodion—is laid over the part ; and the whole is surrounded by some other envelope. Then dissection may be continued in security.

But a more important means of prevention exists, in regard to both the local and general symptoms ; namely, attention to the general health. The robust student is seldom found to suffer ; however many may be his dissection wounds, and however careless he may be of their local management. The stomach and bowels should be kept in a healthy state ; diet should be generous, yet temperate ; a sufficiency of out-of-door exercise should be taken daily ; clothing should be warm, and a clean perspirable

state of the skin maintained ; above all, late hours, and every dissipation, should be most carefully avoided.

Precautionary measures will of course be most attended to under circumstances of especial danger ; as when the body is recent and death has proceeded from puerperal disease, particularly from affection of the serous membranes ; and when the dissector happens to be, from any cause, in indifferent health, and thereby predisposed to suffer.

When local symptoms have become established, the treatment is according to general principles. The pustule is opened, and covered by a poultice, or by warm water-dressing ; the part is diligently fomented ; and if angeioleucitis be threatened, the application of a warm and weak solution of the acetate of lead with opium will be found grateful. If erysipelas occur, or erythema prove troublesome, punctures by the lancet with the view of local depletion will be expedient. If erythema be but slight, light application of the nitrate of silver will suffice. When abscess has formed, or when diffuse suppuration threatens, free incision cannot be too early practised at the affected parts ; in the latter case, it is only by incisions, almost deserving the term heroic, that disaster can be averted. The wounds are treated by water-dressing ; and, at an early period, uniform and moderate support by bandaging should be afforded.

2. *For the general symptoms.*—In the first form—general derangement without local affection, and independent of wound—application of the cause is plainly to be discontinued ; that is, the dissecting room is to be left for a time, and the free open air enjoyed, as much as circumstances will permit. Also, the natural efforts towards extrusion of the deleterious matter are to be duly seconded ; by purging, diaphoretics, and diuretics ; but especially by the two first. There is a natural tendency to both diarrhoea and sweating ; and, by suitable means, these are to be regulated and maintained until elimination seem to have been complete. Afterwards, a tonic system of treatment is to be enjoined ; more especially generous diet, and exercise in the open country air. Town life, study, and dissection, need not be resumed, until convalescence is fully established. Usually, no long period of absence is required.

The constitutional symptoms of the second kind—those which attend on puncture, and the local accidents which result from it—are not so easily overcome. On their first accession, elimination is still to be attempted ; by purging, full emesis, and diaphoresis ; and these measures, at the same time, tend to moderate the febrile symptoms. During the short sthenic or inflammatory stage, gentle antiphlogistics are expedient ; but general blood-letting, or other heroics, are seldom if ever warrantable. In the more urgent cases, calomel and opium, given so as to lay hold of the system, are sometimes beneficial. When suppuration has been fairly established, and especially if it be of the diffuse character, support, iron, tonics, and stimuli, in their turn, are required ; as in other examples of extreme constitutional irritation.

The more urgent cases are not unlikely to prove fatal. And those patients who escape with life, often retain but a shattered system ever after. They are liable to suppurations, ulcers, and glandular enlarge-

ments ; and to many other chronic disorders, of which debility is the prevailing type.

Affections of both part and system, in many respects resembling those arising from dissection wounds, not unfrequently occur in nurses or others who attend unwholesome sores, or who are employed in the washing of foul linen. Similar treatment is required ; tartarized antimony in nauseating doses internally being regarded by such patients quite as a specific. Both practitioners and nurses may contract chancres and syphilis from punctures or rag-nails, exposed to contamination while in attendance upon patients suffering from these conditions ; and the true nature of the disease is sometimes overlooked, till the unmistakeable signs of constitutional contamination become apparent. The treatment under such circumstances is that of the form of specific disease contracted.

Poisoned Wounds by Healthy Animals.

The Stings of Insects may be formidable by their number, by the susceptibility and state of system of the person injured, and by the nature of the part affected. Poison introduced by the stings of a swarm of bees, wasps, or hornets, may be sufficient to prostrate even the strongest individual ; but such an intense and concentrated form of the mischief is of rare occurrence. A less amount of injury done to a young child, to a nervous and delicate female, or to any one of temporarily reduced power, may be equally alarming in its effects. The sting of a solitary bee or wasp in the fauces, as sometimes happens to the incautious eaters of fruit, is likely to produce such an amount of acute swelling as to threaten rapid asphyxia. But, ordinarily, the stings of insects in this country are neither many nor serious.

In the first place, the part or parts should be minutely examined by means of a lens ; and if the stings are found inserted, they should be carefully removed by finely-pointed forceps. *Liquor potassæ*, a solution of carbonate of soda, or weak ammonia, are supposed to have the effect of neutralising the virus ; the wound, consequently, may be wetted with any of them. Then, perhaps, the best application, both in theory and practice, is the continuous use of cold ; a remedy simple, effectual, and always within our reach. Constitutionally, restoratives may be required, at first, to remove the shock under which the patient may be found labouring ; partly from fright, partly physical from introduction of the virus. For this purpose nothing answers so well as aromatic spirits of ammonia. Afterwards, calmatives to the nervous system and gentle antiphlogistics may be expedient ; to subdue slight febrile excitement. In the formidable case of injury to the fauces—threatening asphyxia by rapid mucous swelling—scarification of the part, fomentation outside and in, and the due amount of antiphlogistics, are required ; employed actively. And should such means fail, tracheotomy ought to be performed.

The Bites of Serpents, in hot climates, are extremely formidable. In this country they are comparatively trivial ; man having no worse enemy, in this class, than the common viper ; whose venom is sufficiently powerful to kill the smaller animals, but fortunately is comparatively

harmless in the human subject.* A person bitten is apt to be much alarmed; and requires restoratives and re-assurance, accordingly. The part swells, and becomes painful and red; undergoing a certain amount of the inflammatory process, but seldom attaining to the suppurative stage. The ordinary applications are expedient; continuous cold, in the

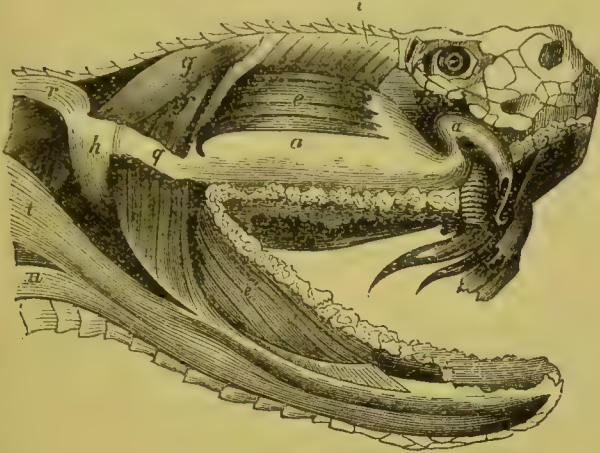


Fig. 205.



Fig. 206.

first instance, to moderate and arrest the process, if possible; failing which, fomentation and the other antiphlogistics. The virus is so weak as regards man, that precaution need hardly be taken against absorption, except in the very young and very old. The constitutional effects are slight, if any; the local may be accounted for, almost, by the mechanical injury alone.

* "Insects are the curse of tropical climates. The *bête rouge* lays the foundation of a tremendous ulcer. In a moment you are covered with ticks. Chigoes bury themselves in your flesh, and hatch a large colony of young chigoes in a few hours. They will not live together; but every chigoe sets up a separate ulcer, and has his own private portion of pus. Flies get entry into your mouth, into your eyes, into your nose; you eat flies, drink flies, and breathe flies. Lizards, cockroaches, and snakes get into the bed; ants eat up the books; scorpions sting you on the foot. Everything bites, stings, or bruises. Every second of your existence you are wounded by some piece of animal life that nobody has ever seen before, except Swammerdam and Meriam. An insect with eleven legs is swimming in your tea-cup; a nondescript with nine wings is struggling in the small beer, or a caterpillar with several dozen eyes in his belly is hastening over the bread and butter! All nature is alive; and seems to be getting all her entomological hosts to eat you up, as you are standing, out of your coat, waistcoat, and breeches. Such are the tropics. All this reconciles us to our dews, fogs, vapours, and drizzles; to our apothecaries rushing about with gargles and tinctures; to our old British constitutional coughs, sore throats, and swelled faces."—*Sid. Smith's Works*, vol. ii. p. 147.

Fig. 205. Head of the rattlesnake. From *Cyclop. of Anat. and Physiology*. *aa*, Poison gland, and its excretory duct; the latter cut open at its extremity; *e*, anterior temporal muscle; *f*, posterior temporal muscle; *g*, digastricus; *h*, external pterygoid; *i*, middle temporal; *q*, articulo-maxillary ligament, which joins the aponeurotic capsule of the poison gland; *r*, the cervical angular muscle; *t*, vertibromandibular muscle; *u*, costo-mandibular muscle.

Fig. 206. Poison fang magnified. From the same. *pp*, The pulp cavity of the tooth; *vv*, the canal along which the venom flows, truly on the outside of the tooth.

Though such be the general character of the results of these injuries, yet it is well to remember that, in susceptible frames, the bites and stings of even the least poisonous creatures are not unfrequently followed by very troublesome consequences ; angeioleucitis, abscess, perhaps eruption, and febrile disturbance.

Abroad, the accidents assume quite a different complexion. The bite of the rattlesnake in America, of the Cobra da Capello in India, the Puff-adder in Africa, and of various other snakes, is often followed by rapid dissolution.* The poison, acting on the nervous centres, through the blood, as formerly explained, may speedily arrest their functions ; and the patient dies of vital prostration. Or, reaction having taken place, the disordered state of the blood induces febrile disturbance of a low kind, aggravated by the local changes which meanwhile have occurred in the bitten part ; and under this the patient may sink after a struggle more or less protracted.

The local affection is in itself formidable. By the absorption of virus into the blood, and its subsequent diffusion through the system, vital power is lowered generally. By imbibition of the poison in the part injured, the same result takes place locally. Under the stimulus of the injury, the part inflames ; and the process, advancing uncontrolled, in consequence of deficiency both in general and in local vital power, soon attains its worst results—gangrene, attended with diffuse infiltration of a putrid sanies. This, occurring in an otherwise sound patient, would of itself induce constitutional disturbance of an alarming kind ; but when it affects a system already brought low by the constitutional and almost immediate result of the injury, it can readily be understood that the most dangerous consequences are likely to ensue.

Under such circumstances the required activity of treatment is great, proportioned to the urgency of the case. The first and main indications are—to prevent absorption of the virus, and to obtain its expulsion from the part. With this view, a ligature is to be thrown instantly round the limb, between the heart and the bitten part ; so as to obstruct return of venous blood from the latter. Thus time is afforded for fulfilment of the second part of the indication ; destruction or expulsion of the virus. The wound may be destroyed by actual cautery ; taking care to include the whole of the tainted textures, and something more.† Or if the part be favourably situated, free excision may be practised—with a similar precaution as to margin. Or if that be impracticable, free incision should

* “ Snakes are certainly an annoyance ; but the snake, though high-spirited, is not quarrelsome ; he considers his fangs to be given for defence, and not for annoyance ; and never inflicts a wound but to defend existence. If you tread upon him, he puts you to death for your clumsiness, merely because he does not understand what your clumsiness means ; and certainly a snake, who feels fourteen or fifteen stone stamping upon his tail has little time for reflection, and may be allowed to be poisonous and peevish.”—*Sid. Smith's Works*, vol. ii. p. 140.

† “ The snake charmer in India is provided with very effectual means for safety. The assistant carries small cauteries, in shape and size corresponding exactly to the fangs of the creatures with whom the performer plays ; and in the event of a bite, the cautery, heated in a chauffer also carried for the purpose, is instantly inserted into the wound.”—*Lancet*, No. 1530, p. 694.

be made, and the flow of blood encouraged by every means in our power. Suction by the mouth is beneficial after either excision or incision ; with the view of both preventing absorption, and favouring the flow of blood whereby the virus may be washed away. And, provided there is no breach of surface in the mucous membrane of the mouth, this may be had recourse to with perfect safety to the operator ; experience having shewn that such virus does not act except on a wound or sore. But the application of a cupping-glass is at least equally efficient, and usually more convenient. It should be retained not only during tendency to bleed, with the view of encouraging escape of blood and all other fluids from the part—but for hours afterwards ; experiment having clearly proved that, during its application, absorption takes place very slowly and imperfectly, if at all. Afterwards, it is well to apply the nitrate of silver freely to the part ; for the same reasons as in the treatment of dissection wounds. When diffuse infiltration has begun—as it speedily will, if we have failed in timely and effectual arrest of the virus—free incision is required ; in order to arrest progress, save texture, and mitigate the general symptoms which would otherwise ensue. Some authors recommend in the highest terms the use of a poultice made of Ipecacuan powder.

The general treatment consists in the use of restoratives and stimuli, in the first instance ; in order to avert death by the immediate effects of the poison, and afford an opportunity for baffling its secondary results also. Alcohol and ammonia are all-important here ; in full and repeated doses, till the shock is overcome. Afterwards we look for remedies to meet the peculiar state of system that remains ; and for this end experience speaks strongly in favour of arsenic—the active principle of the famous Tanjore pill. The drug is given in large doses, and with impunity—one grain of the arsenious acid, or two drachms of the liquor arsenicalis ; a tolerance of the remedy having been plainly engendered. Its use is continued until free purging is induced, perhaps proving of service by elimination ; and this may be farther contributed to by emetics and diaphoretics, according as the rallied system will bear. Sometimes vomiting is spontaneous and excessive, tending to hasten exhaustion of the patient ; under such circumstances, it is to be moderated by opium, and the application of sinapisms to the epigastrium. Sinapisms along the spine, too, may be useful. The principal danger having been overcome, tonics, change of air, and generous diet are indicated.

Many cases, as can be readily understood, prove fatal ere assistance is obtained. Others are seen too late for employment of the means suited to the prevention of absorption. In such, attention is directed to the constitutional treatment—in order to obtain time for and to assist in elimination—and to local management, by incision and otherwise, so as to limit the inflammatory accidents in the part.

Poisoned Wounds inflicted by the Bite of Diseased Animals.

The most prominent feature of these is the fearful malady which occasionally results from the bite of a rabid animal, and is termed *Hydrophobia*.

Rabies in the Dog.—This disease is said to be of two forms.

"The *first* is characterised by augmented activity of the sensorial and locomotive functions, continued and peculiar barking, and a strong disposition to bite (the *Rasende Wuth* or raging rabies of Hertwig). The affection commences with some alteration in the peculiar habits and disposition of the animal, who, as the case may be, is more irritable, more tractable, more lively, or more sluggish than usual; or these several conditions may alternate in one and the same animal. An early symptom consists in an inclination to lick, or carry in the mouth, various inedible substances, especially such as are cold. The animal after a time gets restless; snaps in the air, as if at flies, frequently leaves the house, but soon returns; and is obedient and seems attached to his master. According to Blaine, constipation constantly exists. There is usually complete loss of appetite; but the animal seems to suffer from thirst, drinking eagerly, until, as indeed usually occurs, the mouth and tongue become swollen. The eyes are red, and become dull, haggard, and half closed, the skin of the forehead being also wrinkled, which gives the animal a peculiar aspect. The nose, tongue, and throat, now usually become swollen; and the coat becomes rough and staring. According to Hertwig, the mouth is generally very dry; but Blaine has constantly observed a flow of thin saliva. After some time, the gait becomes unsteady and staggering, and finally the extremities are paralyzed. The tail, in this form of the disease, is not drawn between the legs; and the head is carried erect; the nose being pointed upwards. A disposition to bite, sooner or later, invariably occurs; it is not, however, permanent, but recurs periodically; is directed against both inanimate and animate objects; most especially against the cat, less so towards other animals, and least of all towards man. When the animal bites, he does not previously bark or fly at the object of his attack, but approaches in a quiet or even friendly manner, and makes a sudden snap.

"The *second* form of the disease is distinguished by inactivity and depression (the *Stille Wuth*, still or calm rabies); there is no disposition to bite—probably from the lower jaw being paralyzed; nor is there any inclination for change of place manifested. The first symptoms are unusual quietness and apparent depression of spirits. The voice is peculiarly altered, as it is also in the foregoing variety, but there is much less disposition to bark. The mouth is open, the lower jaw hangs as if paralyzed, and is raised only under the influence of strong excitement; there is a constant flow of saliva from the mouth. The animal either does not drink at all, or does so with difficulty; but manifests no fear of water, and, on the contrary, willingly immerses the nose in that fluid. The tongue is almost constantly protruded from the mouth."* The animal rarely survives beyond the sixth day; never beyond the tenth. Thus we see that the insanity and alleged dread of water of the dog are but vulgar errors, in connection with this disease; some animals, indeed trained to certain duties—as pointers—have performed these while in the rabid state, quite as efficiently as when unaffected. The most invariable symptom is the rough harsh short bark, suddenly changed into short howl; very peculiar, and quite characteristic.

* British and Foreign Medical Review, No. 25, p. 50.

Hydrophobia.—The saliva of a dog, labouring under such a disease, is supposed to contain a virus, the introduction of which by inoculation is capable of producing Hydrophobia in the human subject; a disease so termed, not because there is truly a dread of water, but because, in man, the most prominent symptom is inability to swallow, and unwillingness to attempt to swallow, any fluid whatever. Two points in regard to the virus of Rabies are peculiar. First, a long period of latency exists; symptoms of the disease, in man, seldom shewing themselves sooner than from the thirtieth to the fortieth day after inoculation. Matured zymosis seems to be essential to production of the full influence of the poison. Second, inoculation is not invariably followed by the untoward symptoms. A number of people having been bitten by the same animal, a few only—sometimes but one, sometimes none at all—fall victims to hydrophobia.

The virus of rabies is understood to be originally produced—but now, is uncertain—in the dog, fox, wolf, jackall, cat, and badger; and from them to be communicable by inoculation to many others. But it still remains an open question, whether or not these in their turn are capable of reproducing the disease; although the preponderance of evidence and belief, no doubt, leans toward the affirmative.

The most dangerous mode of injury is by bite, on a part unprotected; as the hand or face. A bite through clothes is less formidable; inasmuch as it is probable that the greater part of the virulent saliva has been entangled in the exterior of the cloth, and does not reach the wound. But, on the other hand, a bite is not essential. There may have previously existed a scratch, sore, or open surface of any kind, and from the licking of this by a rabid animal inoculation will be at least equally certain. The virus is inert on sound skin; as well as when taken internally, without breach of surface in the mucous passages.

Some authorities on veterinary surgery have been bold enough to deny that hydrophobia (as designated) ever occurs in the human subject; believing that what we term such is a simulation, of a nervous character, induced by dread and alarm. But this fancy is sufficiently disproved by the fact, that children have been victims of the disease; as well as adults who, from ignorance of the very existence of any such malady, could not have been influenced by the mental condition supposed. There is no doubt, that by anxiety of mind a nervous simulation may be induced, especially in hysterical females; but this can readily be distinguished from the real disease, and is of an altogether different character as to its result; seldom, if ever, proving fatal. Further, the mind may have some power to hasten the accession of the true disease, and perhaps even to cause its aggravation.

The period of incubation—that is, the period between the bite and accession of the direful symptoms—is, in man, invariably long; as already stated. Its average may be said to range between five and ten weeks. According to some, even years may elapse. But a fallacy must surely have existed in such cases; an intercurrent injury or inoculation having doubtless taken place, though of so slight a nature as to have failed to attract attention. The symptoms of the disease are generally divided into two kinds; the premonitory and actual.

1. The wound usually heals up in the ordinary way ; generally by granulation. But, after a time, pain and itching are felt in the cicatrix and its neighbourhood. The pain increases, and extends up the limb, usually in the course of the nerves ; unaccompanied by discoloration of the integument, except at the cicatrix, and not increased by pressure or motion ;—it is neuralgic. The cicatrix becomes swoln and discoloured, and usually ulcerates, discharging a thin unhealthy pus. The general system shews disorder of a febrile character ; and marked headache supervenes ; with restlessness, disturbed dreamy sleep, increase of shooting pains from the injured part, flying pains in other parts of the body, and other evident signs of much excitement of the whole nervous system. There is great acuteness of the senses, and of the intellectual functions ; memory is strong, imagination vivid and fertile, the countenance animated ; the eyes sparkling and clear, but intolerant of light. This state, however, is apt to be succeeded by dull despondency ; the result, probably, of mental depression and fear. The pulse is usually more frequent and strong than in health ; and yet not of the true inflammatory character. Then comes the dread of fluids ; completing the first stage ; the duration of which is short, never exceeding six days, and usually limited within two or three. In some cases, the premonitory symptoms do not occur, or at least are marked most imperfectly.

2. The second stage commences with a dread of fluids. Frightful agitation—accompanied with painful spasm of all the muscles of respiration, especially in the neck, and convulsive difficulty of breathing—is produced by even the sight of liquids ; by hearing fluids in motion, or poured from one vessel to another ; by the sudden contact of even a breath of cold air ; and by the idea of drinking. The patient, usually is well aware of his state ; and, racked with a burning thirst, may try to overcome this instinctive aversion. Summoning a tremendous courage, he may make a dash at fluid, and obtain a mouthful ; but convulsions are sure to follow, most likely preventing deglutition of more than a few drops. Sleep is now lost entirely ; and the mind is strangely altered. Despair has taken firm root ; the patient considering his doom inevitable and wishing to be relieved by death from his intense suffering ; yet often talking with volubility and assumed ease, on subjects indifferent or trifling in the vain attempt to conceal his real condition. Sometimes, anxiety is obscured by no attempted concealment ; and occasional screams attest the horror and suffering. The general surface is extremely irritable to the slightest impression on it exciting paroxysms. And these are produced, not only by the sight, hearing, and thought of fluids ; but also by the sight or hearing of objects connected with them, as cups, tea spoons, etc. This hydrophobia may remit for a time ; in some few cases, an intermission has occurred, and swallowing of drink has been accomplished with comparative ease ; but the amendment is deceptive and the paroxysms recur in a more intense and enduring form. There is pain in the neck and throat ; and pain in the epigastric and diaphragmatic regions ; often occasional vomiting of dark, bilious matter. A thick tenacious sputum accumulates in the mouth and throat ; occasionally it is seen frothy on the lips, in consequence of the difficult respiration ; and the attempts to dislodge it, by hawking and expector-

ion, are very frequent and distressing. The voice is changed, and hoarse; but it requires fancy to assimilate it to the barking of a dog. Occasionally, a croupy noise is made in respiration, during spasmodic contraction of the glottis. Sometimes there is an inclination to bite; not, usually, from savage inclination; but involuntarily and unwittingly—the patient often taking care to forewarn his attendants.

As the disease advances, cerebral excitement and disorder become more and more apparent. The eyes are staring, bloodshot, and never shut; hearing, sight, and touch, are wonderfully acute, but deceptive; speech is abrupt and rapid, often incoherent; and at length delirium is confirmed. The paroxysms of difficult breathing, with spasm of the muscles of the throat, become more and more marked; in one of these the patient dies asphyxiated; or he sinks, exhausted, during a period of remission. And such is the second stage; usually of even shorter duration than the first. Sometimes, death is immediately preceded by complete remission of all the symptoms.

The morbid appearances, usually observed after death, are congestion, with serous effusion, in the brain and spinal cord, and in their membranes. The mucous membrane of the stomach and fauces is increased in vascularity; that lining the air-passages is often in a similar state, and the lungs are much congested. The whole blood is dark and grumous, wanting in serum.

Tetanus is the disease with which this is most apt to be confounded; yet the differences are sufficiently marked. The spasm of the muscles—of the neck and jaw especially—is continuous in tetanus; remitting, but never intermitting. The jaw is usually much in motion in hydrophobia, in frequent attempts to clear the mouth and throat by hawking and spitting the peculiarly tenacious mucus; in tetanus it is rigidly fixed. Tetanus is rarely attended with aversion to liquids; on the contrary, the bath is grateful; nor are the tetanic paroxysms increased by the sight, hearing, or touch of fluids. Also, tetanus makes its accession usually at a much earlier period after infliction of the injury. Physiologically, while tetanus is a disease of the true spinal system, hydrophobia involves the brain also; as evinced by the disorder of intellectual function and special sense, even early in the disease. While, in tetanus, the stimulus which excites the paroxysms “operates through the true spinal cord; in hydrophobia it is often conducted from the ganglia of special sense, or even from the brain; so that the sight or sound of fluids, or even the idea of them, occasions, equally with their contact, or with that of a current of air, the most distressing convulsions.”*

The characteristics of the hydrophobic symptoms may be briefly stated as follows:—They are paroxysmal; having marked remissions, and occasionally intermitting. Breathing and deglutition are the functions most prominently affected, by spasm of the muscles therewith connected. The external surface is extremely irritable. The intellectual functions are perverted; often from the first; but not truly deranged till near the close. The paroxysms are excitable by sight, hearing, touch, and thought suggesting the idea of water. The virus of rabies injuriously affects the nervous centres; increasing their excitability to such an

* Carpenter.

extent, that the slightest causes are sufficient to induce the most violent spasmodic actions.

Treatment.—The principal duty of the surgeon consists in adopting means for *prevention*; those of *cure* cannot be said to be within the reach of surgical skill. A person bitten under suspicious circumstances is usually much alarmed, and applies for relief without delay. Our first business is to inquire into the history of the accident; the disposition and character of the dog; its apparent condition at the time; whether loose or chained, whether provoked or not. For it may happen that the animal was not to blame, having been either provoked to an assault in its own way; or having inflicted the bite with the idea of discharging a supposed duty on an aggressor. Such a wound is not supposed to contain any virus, if the animal be apparently in sound health, and of its ordinary mood; and no special treatment is required. If there be any reasonable grounds for doubt, however, let error always be approached on the safer side, and the treatment be conducted as if inoculation by virus had actually occurred. It is better that an unnecessary severity of treatment should be adopted, than that any risk should be incurred of the accession of an almost certainly incurable disease. If the animal be undoubtedly rabid, it should be killed instantly; for very obvious reasons. If it be apparently well, and yet have inflicted the injury under suspicious circumstances, it is better to keep it in quarantine, but without the knowledge of the patient. If the animal become rabid, it should be put to death secretly; but if it remain well over the fifty days, usually allotted as the period of probation, it should be shewn to the patient, as a most powerful means of re-assurance. Indeed, if the next six or ten days pass over without the appearance of symptoms of rabies, we may rest satisfied that the animal was not rabid at the time of the infliction of the bite.

The surgeon, when satisfied that the bite has been inflicted by a rabid animal—unless when this has happened through a considerable thickness of clothes—at once proceeds to excision, when that is practicable; and effects it in a thorough manner; carefully ascertaining with the probe the extent to which the teeth have pierced, and taking care that the knife goes beyond this on every aspect. Afterwards, it is well to apply a cupping glass, exhausted (Sir D. Barry); so as to encourage bleeding, and oppose absorption. If there be any uncertainty as to the whole of the injured parts having been removed, let caustic or the actual cautery be applied freely. As before stated, it is better that the patient suffer pain unnecessarily, than that any portion of the virus should be permitted to remain. Some authorities prefer caustic to excision. Mr. Youatt, for example, reposed much faith in the nitrate of silver alone. And perhaps its chemical effect on the virus may be fully equal to its destructive action on the tissues; for the latter we know is but slight. His experience and success were great; 400 cases of bite, by dogs undoubtedly rabid, and not one example of hydrophobia. Yet excision is surely demanded of us, when practicable, as an additional and more effectual means of security; the chemical agent being afterwards employed, if deemed necessary, to render assurance doubly sure. If the part be mangled in such a way as to render it impossible to obtain accuracy in

either excision or cauterization of the bitten parts—as sometimes happens to a finger, or even to a whole hand—amputation should certainly be performed (Delpech).

Along with such local treatment, it is important that the general health be attended to; and more especially, that every means be taken to maintain a state of mind free from anxious forebodings as to the result. As formerly observed, should an opportunity occur of shewing the animal alive and well, that precaution should never be neglected; communicating at the same time the encouraging fact, that among those who have actually been bitten by a rabid animal the occurrence of rabies is not the rule but the exception.

It has been said that the bitten person generally loses no time in applying for surgical aid. But it sometimes happens that days have elapsed ere the surgeon is consulted. And then arises a question, as to whether excision, at that period, is likely to afford a favourable chance of exemption; or whether the virus must have been already absorbed, and diffused throughout the system. This question can only be answered by experience; and experience has declared in favour of operation even at a late period. The apparent success of such tardy operations may perhaps be explained by the fact already alluded to, that all those bitten by animals truly rabid do not fall victims to the disease; but another explanation also offers itself; namely, that local zymosis may not have been completed, and that, consequently, such excision may be in time to prevent systemic diffusion.

Dr. Marochetti (of Moscow) maintained that characteristic pustules form beneath the tongue, near the orifices of the submaxillary glands, between the third and ninth day from the infliction of the bite. This has also been observed by M. Magistel of Saintes; who, however, does not corroborate Marochetti's experience, that if these pustules be punctured and timeously cauterized with a hot needle, the disease is aborted; large doses of butchers' broom (*genista tinctoria*) being at the same time given internally. Most others, however, have not been able to detect these pustules. And yet it may be well to look for them. If found, they should certainly be cauterized.

Of the *curative treatment*, little can be said that is at all satisfactory. A few examples of recovery are on record; but they are only exceptions to the general rule. And, towards these recoveries, there is no striking proof that the treatment was especially conducive. There is scarcely any remedy which has not been tried; of the more important only is it necessary to speak, and that shortly. Bleeding and other active antiphlogistics have failed, after abundant trial. Bleeding is warrantable only in the robust, and at the very commencement of the disease; chiefly with the view of facilitating the operation of that class of remedies in which our trust will most naturally be placed—the calmatives of the nervous system. A sedative, such as opium, Indian hemp, belladonna, hyoscyamus, may be given in large doses, and as often repeated as circumstances indicate and will permit. The solid form, of pill or bolus, may be swallowed, when fluids cannot; and when deglutition in any way is found impossible, the skin, rectum, veins, and subcutaneous areolar tissue yet remain, whereby administration may be effected; but expe-

rience leads to the conclusion that, however administered, even in very large doses, the remedies afford but very temporary alleviation. The hydrophobic symptoms have a close resemblance to those induced by over-doses of strychnia ; and aconite is reckoned the best antidote to this poison. To Aconite, Conium, Woorara, and Physostigma (Calabar bean), accordingly, the attention of the profession has lately been directed in connection with this disease. Dr. Sibson's experience of the use of woorara, in a case which occurred at St. Mary's Hospital, London, has not been of a kind to lead us to expect much from its re-employment. Magendie observed, in experiments on animals, that nervous agency was remarkably subdued by injecting water into the veins, so as to induce an artificial aqueous plethora ; and we have already seen that in hydrophobia the general mass of blood is black and grumous, palpably deficient in serum. Injection of water into the veins, therefore, is feasible in theory ; in practice, it has been to a certain extent successful. And further repetition is perhaps warrantable, with the hope of alleviation, at all events, if not of cure ; the operation being, of course, carefully conducted. The hyperæsthetic condition of the spinal cord has naturally been treated in various ways. Instant vesication over the upper part of the spine, by ammonia, with subsequent endermic use of morphia or other sedatives, has in some instances afforded decided relief ; and may be resorted to. A very powerful sedative of easy application may be employed ; namely, ice, contained in the large intestine of an animal, applied along the spine, and over the back of the head. The effects require to be carefully watched, however, lest the sedative result prove excessive, and fatal prostration ensue ; and, further to counteract this, support by nutrient enemata should be afforded at the same time ; stimulants also being employed, if required. Ice, too, may be kept in the mouth, as an additional sedative measure, and a palliation of the raging thirst ; and ice, curiously enough, though closely connected in idea with water, is usually most grateful to the patient. The details of a case so treated in King's College, London, under Dr. Todd,* are such as to hold out, in further experience of the remedy, hope of palliation at all events. From inhalation of chloroform a good deal was naturally expected in this disease ; but, as yet, it too can be ranked only with the palliatives. It will always, however, prove serviceable in enabling the medical attendant to administer nutritious injections and medicines by means of the stomach pump, and has even in some cases admitted of the patient while partially unconscious, drinking fluids without the induction of convulsions.

During the administration of all remedies, it is obviously of much importance to keep the patient carefully secluded from excitement by light, noise, or otherwise ; and to afford what nourishment is in our power.

Lately it has been proposed to perform tracheotomy, in order to avert asphyxia by spasmodic closure of the glottis ; but at the best, this can only palliate. And it is to be remembered that death frequently takes place, not from asphyxia, but during remission of the spasm, from mere exhaustion.

* *Lancet*, No. 960, p. 583.

Inoculation of Virus from an Animal not Rabid.

Equinia or *Glanders*.—The horse, ass, and mule, are liable to a disease, which, according as it manifests itself chiefly in the lymphatic system, is termed *Farcy*—or in the nasal passages and skin, is termed *Glanders*. The virus of this disease, received into the human system, deranges the whole blood, as poisons usually do ; and is capable of producing a series of symptoms closely analogous to those which occur in the lower animal. It is communicable both by contagion and by infection ; but chiefly by the former mode. When inoculation by wound takes place, the local symptoms precede the constitutional, and are such as follow poisoned wounds in general.

There is at first fever, of variable character ; sometimes sthenic, more frequently asthenic in type ; and soon followed by pains in the limbs and joints. “Hard, circumscribed, subcutaneous tumours form on the parts that are the seat of pain, in the vicinity of the joints or elsewhere on the extremities, or on the trunk. The skin covering the tumours may fall into gangrene, but they usually suppurate, and when opened generally yield a sanious or bloody discharge. Between the fourth and the sixteenth days, a nasal discharge appears ; not, however, uniformly. In some cases, this symptom is only apparently absent ; pressure causing a discharge from the nose, or decubitus causing it to run into the mouth. The discharge is usually from both nostrils, is rarely abundant, is yellowish, viscid, and sometimes purulent and streaked with blood. The nose and adjacent parts are occasionally swollen ; and in two cases gangrene of the nose occurred. At an uncertain period of the malady—at a mean term, perhaps on the twelfth day—a principal and remarkable symptom occurs, which consists in the appearance of a pustular eruption, or gangrenous bullæ, on the face, trunk, extremities, or genital organs. The pustules appear in succession, and usually occupy the face, arms, thighs, and anterior surface of the trunk ; they have been compared to the pustules of small-pox, but their appearance is peculiar and specific. The bullæ may be followed by gangrene, varying in extent and depth. Whatever the original type of the fever may have been, it now becomes of a typhoid or adynamic character. The duration of the disease is short. In two-thirds of the cases, death occurred before the seventeenth day ; one only survived on the fifty-ninth day.”* As yet, the fatality has been almost without exception.

The disease may be either acute or chronic, in its general character ; the symptoms and appearances varying accordingly. The chronic form can scarcely be said to invite higher hopes of recovery.

When there is an absence of nasal discharge, and of pustules or ulcers in the schneiderian membrane ; when the characteristic eruption is present ; when also numerous soft doughy tumours form in various parts of the surface, remote from the point of inoculation—usually on the extremities ; and when these tumours are seldom resolved, but almost constantly suppurate, and sometimes pass into gangrene—large subcutaneous abscesses, also, sometimes forming in the limbs—the disease may be termed *Farcy* ; chronic or acute.

* British and Foreign Review, No. xxv. p. 33.

The means of prevention are sufficiently obvious. Those of cure consist in a mitigation of symptoms ; by fomentation, poultice, or water-dressing of sores and pustules ; by evacuation of abscesses, and free incision of infiltrated areolar tissue ; by the use of dilute liquor chlorinii, or the chlorurets, as an injection up the nostrils, corrective of fœtor ; by the application of various alteratives to the sores, as their appearances may indicate ; and by supporting the general strength by diet and stimuli, as circumstances may require. The alterative said to be most suitable for application to the sores, is creasote in solution ; and the use of the liquor chlorinii internally in drachm doses, frequently repeated, seems more likely to be beneficial than any other internal remedy hitherto employed.

Malignant Pustule.

What is called (somewhat absurdly) "*The Malignant Pustule*" may occur with or without breach of surface ; but only by contagion. And, of course, inoculation is the more rapid and certain means of communicating the disease. It shews itself chiefly in cattle, in the autumn—specially in those pasturing in low marshy situations ; and is propagated by a poison communicated from animals affected with the "Bovine disease,"—a typhoid affection, of which a rapidly fatal pleuro-pneumonia and the formation of carbuncles are the prominent symptoms. Not only oxen, but sheep and pigs also suffer in the same way. The infecting animal may be either dead or alive ; the patient's cuticle may be either entire or abraded. Some have asserted that the tainted flesh taken internally, as food, will produce the disease. No doubt, serious constitutional disorder will in all likelihood occur under such circumstances ; and the skin may become affected by an eruption, probably degenerating into troublesome sores ; yet the true "malignant pustule" does not form but by inoculation. At all events, it yet requires to be proved that the disease is communicable either by eating diseased flesh, or by inhalation of tainted atmosphere ; and, meanwhile, probability leans much towards the negative.

The disease, as occurring in the human subject, may be divided into two periods ; in the first, we have the local symptoms appearing and increasing in severity ; in the second, the constitutional manifest themselves and advance towards the fatal termination. 1. After some itching and inflammatory irritation, a dark vesicle forms on the mere surface of the skin, and, bursting, discharges a brownish fluid. The true skin becomes involved, and while the vesicle is surrounded by a dark inflammatory areola, the skin and subcutaneous tissue become infiltrated, thickened, and constitute the base of a carbuncular boil, which is accompanied with pain of a severe burning character, and, it may be, with lymphatic irritation extending to the trunk. This carbuncular boil now becomes phagedænic and sloughing and preceded by a diffuse inflammatory process, extends its ravage more or less rapidly. 2. Meanwhile the patient has been suffering from inflammatory fever of an irritative type ; marked typhoid depression gradually develops itself ; and a fatal issue, preceded by delirium and

collapse, may take place from within thirty-six hours to ten days after the local invasion.

The hands, being the parts most liable to be acted on by the deleterious matter, are the most frequent seat of the disorder. The persons most commonly affected are butchers, pig-stickers, farriers, tanners, curriers, and wool-pickers, and others whose occupation brings them into contact with animals, or animal remains.

The indications of treatment are in the early stage the same as for dissection punctures, viz., to arrest the action of the putrid virus, and, at a later period, to avert or diminish the constitutional result. The part is to be destroyed, at as early a period as possible, by an escharotic. The nitrate of silver may suffice at the very outset ; but when the condition of a carbuncular boil is developed, either nitric acid or the potassa fusa will prove more suitable. Separation of the slough is watched ; and should the subjacent parts seem still unsatisfactory, the caustic should, without delay, be freely reapplied. When phagedæna has commenced, and is extensive or complicated with rapid sloughing, iron lotion, or a solution of the permanganate of potash and iron, may be advantageously applied subsequently to the use of the caustic. If the disease is checked in the early stage, constitutional remedies will not be needed ; if, however, irritative fever have set in, tonics, iron, quinine, ammonia, and stimuli, regulated by circumstances, should be administered.

VI. GUNSHOT WOUNDS.

This term is applied to injuries inflicted by musket, rifle, pistol, or cannon shot, by splinters on board of ship, by stones in garrison, and by the bursting of shells, etc.

They are always more or less of the contused and lacerated character ; followed by sloughing and suppuration ; and, as a rule, never healing but by the second intention. The sloughing is in part an immediate result ; partly secondary, from consequent inflammatory accession, as in other contusions. Hemorrhage is seldom sudden and great, unless a large artery be directly implicated. Yet, gunshot injury being generally extensive, and arteries of some considerable size consequently certain to be more or less wounded, danger is not slight from even direct loss of blood. Often, from the punctured form of the wound which the smaller missiles inflict, little blood may flow externally, while a fatal hemorrhage is advancing in the interior. The extent of injury is very various. A ball may merely graze the part, scarcely inflicting a flesh bruise ; or it may impinge, so as to fracture bone, without division of the integument. It may enter a part, and lodge ; or it may effect complete perforation. A limb may be carried away, as if by a rude amputation ; or it may be pounded almost to a jelly, yet remain continuous with the living trunk. The cannon ball seldom lodges. Round shot have been found imbedded in the glutei, or even in less fleshy parts ; but the occurrence is rare. Hennen mentions a case of this kind, where a 12 lb. shot lodged in the thigh of an officer, who was carried wounded from the field to camp ; and its presence was only detected on post-mortem examination. Lodgment of

the musket bullet—as well as of individual grape shot—on the contrary, is not uncommon. When the missile is a round ball discharged from a musket of smooth bore, the aperture made by its entrance is comparatively small in most cases, and with the margins inverted and discoloured; often it appears of much less dimensions than the foreign body which has passed through it; and sometimes it may even simulate the incised character. The aperture of exit, on the contrary, has its margins ragged and everted; and is usually of larger dimensions than that which marks the entrance. When the injury has been inflicted at “close quarters,” the aperture of entrance is comparatively large, has no smoothness in its edges, and is obviously of a lacerated character; then, too, portions of the wadding are usually impacted in some part of the track; and the surface may be marked by grains of powder.

The appearances in wounds produced by conical bullets discharged from rifled fire-arms (“arms of precision”) vary materially, according to the more or less pointed extremity of the projectile, the force with which it is travelling, and whether it rotates on its long or on its short axis on coming in contact with the body. The wound of entrance sometimes closely resembles an incision; in other cases it differs little from the wound of exit—both being ragged tears. In the first instance, the conical ball seems to “rifle” through, rotating on its long axis; in the latter, travelling with less velocity, or coming obliquely upon the surface, it has still sufficient force to pass through, but rotates on its short axis.

Striking obliquely on the surface, a ball of any form, without perforating, may plough up the superficial textures; the parts being most injured at the point first struck.

The pain of a mere flesh wound is often slight; not more usually than the sensation of receiving a smart blow which benumbs the part; and the patient, if actively engaged, may hardly be aware that he has sustained injury. If a bone be broken, or a large nerve torn, however, pain is usually severe; though cases have frequently occurred in which the wounded man was first apprised of his injury by his falling on the ground, by his arm hanging useless to the side, or by blood flowing from the sleeve, the boot, or the stirrup-iron.

The shock, too, varies. As in other injuries, it may be of two kinds; mental and corporeal. The former is temporary, may exist without any serious injury, and ordinarily gives way to re-assurance. The latter may be aggravated by the former; but is itself wholly independent of the mind. The bravest, and the most actively employed, are laid prostrate by it. It is proportioned to the extent of injury, the importance of the part affected, and the amount of blood lost. If a limb has been carried away by a round shot—or if an internal organ, as the lung, stomach, liver, has been implicated in the course of a bullet—the patient is found in a state more or less approaching to syncope, and struck with an alarm and apprehension over which he has no control. Whereas, by a simple fracture or flesh wound, the same patient would scarcely be disturbed from his ordinary composure. Sometimes, it is true, a certain amount of corporeal and actual shock does attend even on slight injury. But in this case it is usually transient; either quickly passing off spontaneously,

or yielding readily to ordinary restoratives. Cases are on record, no doubt, where a trivial injury has, from the mental depression suddenly induced, been followed by a fatal issue, and where, after death, no serious lesion could be detected elsewhere. When, however, in a case of apparently slight wound, we find much depression of system, which refuses to yield, we may be tolerably certain that what before seemed trivial is in truth severe, and that some internal organ has been seriously implicated.

And yet it is strange how the intense excitement of hot action may prevent or rather modify the shock, to a great extent; though only for a while. "A foot soldier at Waterloo, pierced by a musket bullet in the hip, begged water from a trooper who chanced to possess a canteen of beer. The wounded man drank, returned his heartiest thanks, mentioned that his regiment was nearly exterminated; and, having proceeded a dozen yards in his way to the rear, fell to the earth, and with one convulsive movement of his limbs ended his career. Yet his voice gave scarcely the smallest sign of weakness."

And again when shock does exist in full force it is remarkable how clear and unshaken the mind often remains. At Corunna, "an old officer who was shot in the head, arrived, pale and faint, at the temporary hospital, and begged the surgeon to look at his wound, which was pronounced mortal. 'Indeed I feared so,' he responded, with impeded utterance. . . . He laid his sword upon a stone at his side, as gently as if its steel had been turned to glass, and almost immediately sank dead upon the turf."

At one time, it was supposed that a shock, sufficient to cause instant death, might be sustained from mere concussion; produced by a large shot passing with great rapidity and closeness, yet without actually touching the body; and that laceration of muscles and arteries, with fracture of bones, might be occasioned in a similar way. But it is now well understood, that these are not the effects of mere "wind contusions," as they were termed; but are produced by balls, which have really struck the surface—yet with so little directness, as to merely bruise without inflicting an open wound. An internal cavity, as of the cranium, may sustain even a fatal concussion by the contact of a spent shot, without any signs of an outward bruise; but, usually, the signs of contusion are both apparent and extensive. A round shot, when first projected, passes in a straight course; but soon it assumes a curvilinear, paraboloid direction; and at the same time it rotates on its own axis—this rotation increasing with the increased distance, and the diminished velocity. Sweeping or penetrating wounds are likely to follow obstruction to the first part of its course; while, in its last stage, it may merely roll round or over the part, as a wheel passes over a limb. Attention to this circumstance tends to explain the occurrence of such latent injuries; as well as to account for the remarkably circuitous routes sometimes taken by round musket bullets which penetrate the textures of the body.

The course of bullets, more especially when round, is at all times uncertain. A very slight obstacle suffices to cause diversion from the rectilinear direction—as evidenced by the rebounding of round shot

from water. "A button, a watch, a book, or a handkerchief, has many a time been the means of preserving life," from the musket bullet in former days. And a succession of such obstacles may occasion a most devious track. The aperture of exit may be found very close to that of entrance; and yet the bullet may have nearly completed the circuit of the body. Or a ball may strike the forehead, and emerge at a point directly opposite, in the occiput; as if it had perforated the cranium in a straight line, while in truth it has never been deeper than the integument. In such cases, the superficial track is marked by a discoloured elevation, sometimes slightly emphysematous. In deeply penetrating wounds, the course may be equally unexpected; bone, muscle, fascia, proving the causes of diversion. A ball has entered the breast, and lodged in the scrotum; a ball may penetrate at the upper part of the breast in front, and lodge near the spine at a much lower plane. "In one instance which occurred in a soldier with his arm extended, in the act of endeavouring to climb up a scaling ladder, a ball, which entered about the centre of the humerus, passed along the limb, and over the posterior part of the thorax, coursed among the abdominal muscles, dipped deep through the glutei, and presented on the fore part of the opposite thigh, about midway down." *

As already stated, the nature of the wound depends on the distance at which the shot has been fired, on the nature of the foreign body, and on the force with which it has come. At a short distance, powder will penetrate by its grains, as well as burn by its explosion. At a greater, yet still limited distance, wadding will penetrate, and may inflict a ghastly, lacerated wound; a circumstance often not considered by the inexperienced. Lives have often been lost—and still oftener, seriously endangered—by the reckless discharge, at near distances, of firearms supposed to be harmless because loaded only with powder and wadding. At a short distance, small shot, as in the common fowling-piece, penetrate in a mass, like a bullet; at a considerable distance, the charge scatters, and inflicts a more extensive but less deadly wound. A bullet, when near, passes tearingly into flesh; when discharged more remotely, yet still moving with great velocity, its wound is smaller and more incised; when of very distant source, a round bullet may bruise muscle and break bone, without penetrating or even wounding the integument. Slugs, and irregular portions of iron, necessarily make more extensive and serious wounds than those inflicted by round bullets. The latter, impinging on bone, are apt to be flattened or otherwise altered in shape; and when so altered, they may either pass onwards into flesh, or remain imbedded in bone. On a sharp ridge of bone, a bullet may be bisected; and each half, passing onwards, may perforate; giving rise to two apertures of exit. The modern conical bullet, from a rifled bore, seldom lodges in bone; but, striking with great force, breaks it up into fragments, scattering them into the torn flesh.

Lead pellets, and bullets unaltered from their smooth rounded form, may lodge in a fleshy part without creating much disturbance. In such circumstances, immediately after the infliction of the injury, the soft parts surrounding the ball will be found more or less con-

* Hennen's Military Surgery, p. 35.

densed, by compression, into a fine cellular investment, which has received from Baudens and others the name of the "*primitive cyst*," within which the ball is described as being enclosed. Sometimes when a bullet is lodged, the wound closes in the ordinary way, and perhaps about the ordinary time; the foreign body then becomes surrounded by an adventitious cyst composed of a dense fibrous envelope, usually firmly adherent to the ball and to any inequalities which may exist upon its surface, much as though the surrounding textures had become incorporated with the metallic body—this Baudens calls the "*definitive cyst*." Thus the bullet may remain for years, undisturbed; or it may move gradually from place to place, as from the loins to the back of the heel; causing but little uneasiness, except during atmospheric change—when pain, sense of weight, and general discomfort in the part, are apt to assume somewhat of a barometric character. Sharp, irregular bodies, especially if non-metallic, are, however, seldom so tractable; the surrounding parts do not tolerate their presence; suppuration is profuse, continued, or remittent; inflammatory re-accessions are frequent; and quietude and closure are not obtained, until the offending substance has been dislodged and taken away. Sometimes the inflammatory process ceases, the wound contracts, and the discharge diminishes; yet a sinus remains, communicating with the foreign body, as if indicating and waiting for its passage outwards. In this case the bullet has an envelope of a membranous character; but not shut and serous-like, as in the former case; rather mucous, and with an outlet.

Clothing may either prevent the ball's entrance, or enter and lodge with it. A portion of shirt or handkerchief, for example, may be carried before a bullet, with its continuity unbroken, and become impacted in the wound. On pulling out the invaginated portion of dress, the bullet will roll out from its interior. Or the clothing may be cut out like so many patches, and the portions driven inwards; and these, with like portions of skin corresponding to the aperture of entrance, are likely to lodge while the ball may perforate and escape. Other foreign bodies, too, or substances which come to enact the part of such, may lodge, and untowardly complicate the wound; as portions of earth, stone, wood, and splinters of fractured bone. Portions of the clothing, accoutrements, and even of the body, of one soldier, may be impacted in the wound of his comrade.

Bone may be merely fractured; the injury being compound, but neither comminuted nor complicated. Or it may be broken up into many portions of a spiculated character, with more or less of the fragments driven into the medullary canal. Or it may be simply perforated, with longitudinal fissure extending more or less widely from the aperture. Or a smooth round ball may penetrate only the external part; and lodge in the cancelli, leaving the general continuity of the bone unbroken. Projected very slowly, a similar ball may merely bruise the bone. But such bruise is apt to prove troublesome; exciting inflammatory mischief in a part of diminished power, and so greatly favouring the induction of necrosis. Gunshot injury of bone, indeed, of whatever kind, is always of an unfavourable character, and prone to extensive necrosis; being attended with much bruising of the tissue. Joints may be

simply opened up by direct wound, or by fissuring of the articulating extremity of the bone ; or, in addition, they may have their interior occupied by foreign matter.

The indications of a ball, or other foreign body, having escaped, are not always plain. If there be but one aperture, that of entrance, the natural inference is that lodgment has taken place. Yet there is an exception to this ; when the ball has been lodged in a portion of the clothing carried before it, pouch-wise, and has escaped on the evulsion of that portion at the time of undressing the patient ; also, when the ball has made a complete circuit, and come out at the same spot at which it entered—as has occasionally happened in the head, neck, and chest. When, on the contrary, there is plainly the aperture of exit as well as that of entrance—and the two are nearly in a straight line, or otherwise placed as circumstances would seem to render likely—the probability is that the ball has perforated and escaped. And still we may be mistaken ; for it may have been divided on bone, as formerly remarked, and one part only may have passed out, while the other remains impacted. Or two apertures, nearly in a line, may both be of entrance ; made by two distinct balls, which have lodged. Also, a plurality of openings does not imply a plurality of bullets. The same bullet may perforate and escape, and perforate again ; or, after perforation, it may be subdivided into two or more fragments, and each have its separate aperture of exit. In estimating the likely course for a ball to have followed, the position which the patient occupied at the time the wound was received must always be taken into consideration.

The true extent and danger of a gunshot wound can scarcely be determined, until suppuration has been established. Then the sloughs become detached ; not necessarily involving the whole track ; always greatest at the point of entrance. And, on separation of the sloughs, bones, joints, arteries, cavities, and canals, may be exposed, which previously were deemed unimplicated. In most cases, however, especially when the wounded part is a limb, the extent of the injury and the course followed by the ball can be tolerably well estimated, as soon as the inflammatory process sets in, by the full extent and degree of the inflammatory symptoms which are developed ; though, as a rule, the inflammatory swelling and tension, when fully developed, seem to implicate all the textures of the extremity more or less directly, and not to be confined to the mere track of the ball. When the sloughing is complete, the dead texture which separates is a much larger mass at the wound of entrance than at that of exit ; indicating thus where the degree of contusion was greatest. At this stage of matters, the standard condition of the wounds of entrance and exit is reversed ; the exit small, contracted, healing, perhaps nearly healed ; the entrance aperture wide, gaping, with a yellowish grey slough hanging out like a mass of dirty rag or chewed paper. The process of separation of the slough is usually complete, at the entrance wound, from a week to ten days after the receipt of the injury. The wound of exit is always first healed, even if it be the more dependent of the two apertures.

The accidents which are liable to occur during the progress of cure are many and formidable ; excess of the inflammatory process and of in-

inflammatory fever; gangrene; erysipelas; abscess after abscess, with fresh inflammatory fever, probably connected with the lodgment of foreign matter; diffuse purulent infiltration; inflammatory affection of veins, either in the hard or soft tissues, perhaps of the diffuse and suppurative kind; untoward extension or recurrence of sloughing; hemorrhage on the separation of sloughs, or by subsequent ulceration; accession of sloughing-phagedæna; non-union of fracture; necrosis; caries; exhaustion by hectic; tetanus; pyæmia.

Treatment.—Gunshot wounds are amenable to the rules of treatment adapted to contused and lacerated wounds in general; the leading indications being:—to watch, and if necessary, to expedite disappearance of the shock; to remove foreign matter; to re-adjust the parts, and place them in a comfortable and relaxed position; to moderate the coming inflammatory attack; to promote the separation of sloughs; to favour the contraction and consolidation of the wound; constitutionally, to moderate the effects of local excitement, in the first instance, and subsequently to support the frame for the perhaps protracted efforts of repair. These accidents, when they threaten to occur, are to be met by the ordinary means. The indications for treatment do not require the extension, dilatation, or *debridement* of the wounds which was practised by the older surgeons, any more than the escharotics and boiling oil of a still earlier date. The wound requires no incision unless for exploration of its track; for the arrest of hemorrhage, for the removal of foreign bodies or fragments of bone, for the replacement of herniated internal parts, for the escape of irritating fluids (urine), or of inflammatory products; in other words, unless we can afford present relief, or secure future good, no dilatation of the wound should be practised. As to applications to the wound:—dry lint and a bandage, to secure the patient from bleeding, till he reaches his regimental or divisional hospital; then a pledget of lint soaked from time to time in ice-cold water; or if that cannot be had, and the dressing cannot be frequently changed, lint or tow soaked in olive oil should be applied. When the inflammatory process sets in, if attended with much swelling and tension, dilatation of the wound including the wounded fascia should be practised. Then poultices and fomentation will afford most relief, till the sloughs begin to separate; after which pressure and stimulating lotions should be carefully employed, so as to obtain closure of the sinuses which are apt to form. Should matter, however, collect, then a counter opening must be made in as dependent a position as possible; while rest, good food, stimulants, tonics, change of air, and the other essentials of hygienic treatment are carried out. It is obviously of much importance to ascertain at the outset whether foreign matter has lodged or not. This is effected by gentle yet determined examination of the wound by the finger, and manipulation of the wounded limb; it being well to place the patient, during such examination, in the position which he occupied at the time of the injury, and then to reason on the most likely course of the bullet. A probe is, it must be remembered, of no service at this stage of the wound; affording nothing but confusing results; while the finger, which can be easily introduced in the benumbed state of the parts, and without producing more pain, will give most valuable information. If in any exceptional circumstances, how-

ever, an exploratory instrument should be wished, a common whalebone probang, terminating in an ivory, olivary extremity, will be found more safe than the common silver gunshot probe. When the foreign body is felt plainly in the track of the wound, it is to be removed at once, by the finger or suitable forceps; the wound being dilated if need be. If superficially lodged beneath the integument, it is to be cut down upon and taken away. But if found deep and firmly impacted, it is well to wait for the suppurative stage; and during the relaxation of texture which then occurs, to make the attempt at removal—at a time when the foreign body itself, in obedience to the general law, has begun to seek the surface. In regard to bullets deeply lodged, it ought also to be remembered that they may become encysted and quiescent, giving little or no uneasiness, and may remain so for years; or that, at some future period, they may approach the surface, and ultimately, as it were, invite their own removal.

The bullet forceps, in common use before the Crimean war, were the most unserviceable implements ever contrived for any purpose. The best

instruments for the extraction of bullets are, when near the surface, a pair of stout dressing forceps—or, better, a pair of incisor tooth forceps. These last cut into the lead, and give a purchase upon the ball which even its impaction in bone cannot resist. When balls are lodged beyond reach of the finger they can scarcely be detected in the early stage of the wound; and forceps for their removal through the track of the wound at any period are not usually required. In such circumstances, however, a pair of long uterine polypus forceps, or a pair of Tiemann's (of New York) bullet forceps will be found far more serviceable than any others. These last forceps are long and slender in the shanks, and terminate in long teeth set outwards like the incisors of a mouse, so that they seize and bite into a leaden ball

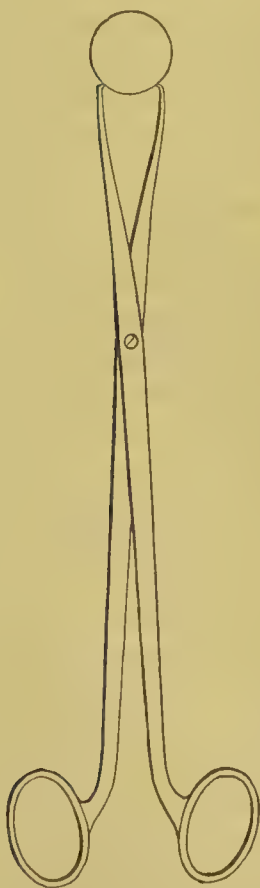


Fig. 207.



Fig. 208.

when only a small portion of its circumference lies exposed to their grasp. When closed, the teeth protect each other; and the instrument passes along much like a probe. They are, of course, of no use in the removal of iron projectiles, or pieces of bone. The bullet scoop with sliding rod,

Fig. 207. Tiemann's ball-forceps, described in the text.

Fig. 208. Old-fashioned ball-forceps; in the act of removing the foreign body.

recommended by some surgeons at the present day, is a practically useless though ingenious toy.

When a bullet penetrates the cavity of the abdomen or thorax, it is very rarely removable; and hunting for it with probes or forceps is out of the question. By some, repeated bleeding, along with the most rigid antiphlogistic treatment, is recommended in the hope of moderating the obstinate inflammatory accession which the presence of the foreign body may be expected to maintain. In some cases, however, balls become secluded from the general cavity of the thorax or abdomen from the very first, by a copious formation of plastic lymph; and even where suppuration ensues, it may be limited, and seek its way to the surface, either intercostally, or by the formation of a communication with the bronchial tubes of the corresponding lung. The mere fact, therefore, of the occurrence of inflammatory symptoms should not lead the surgeon, without due consideration, to resort to bloodletting; keeping in mind, as he should, the risks which a profuse and deep-seated suppuration (which in any circumstances is likely to ensue) will be certain to entail.

When a bone such as the femur has been struck, or even grazed, very careful examination is necessary—assisted by incision, if need be—in order to ascertain the existence of splintering, and to what extent it has occurred. For recent experience has proved, that unless the detached and especially the impacted fragments are thoroughly removed at the time, these portions not only die, but engender the most serious consequences by establishing diffuse suppuration within the medullary canal.

But, very frequently, indeed, the surgeon's first care is to determine whether an attempt should be made to save the injured limb, or whether amputation is necessary. The settlement of this question will be mainly influenced by the probability of the occurrence of gangrene; by regard to the power of system in the prospect of a tedious and suppurative cure, as influenced by age, habits, and previous condition; by the probability of the limb proving useful, or the contrary, if retained; and by regard to the disposable means for conducting the after treatment.

If it be determined to remove the limb, a second question arises as to the proper time for doing so; whether the amputation shall be *primary*, performed before inflammatory accession; or *secondary*, after the suppurative stage has been established, with decadence of the constitutional inflammatory symptoms. In military and naval practice, there is now little of the diversity of opinion which once existed on this subject; decided preference, for very obvious reasons, being given to the primary operation. *Primary amputation* may be performed at three different periods before the advent of the inflammatory accession. (1.) Ere shock has been induced—as may occur on board ship, or in a besieged city—the knife closely follows up the lately inflicted mutilation. (2.) Or in other cases, and more commonly, where this earliest period has been lost or has not occurred, we wait till the shock has passed off—as usually happens within a few hours—and then, during the interval of systemic repose, between depression and excessive reaction, a period whose average range is from eight to sixteen hours, we perform the operation. Lastly (3.) In some cases, when the degree of shock is great and increasing, when there is no evidence of internal lesion, but when

to all appearance the systemic shock, the gradual loss of blood, and the distance the wounded man has been brought, make it probable that the injury to the part is the cause of the increasing depression, the performance of immediate amputation, without waiting for reaction, should be proceeded with; the patient being brought fully under the influence of chloroform as a preliminary proceeding. Further shock is thus saved, bleeding satisfactorily arrested, and the patient in all respects put in a more favourable condition for a rally than he was previously. The mangled limb is thus, by primary amputation, converted into a simple flesh wound; and the dangers of gangrene, high inflammatory fever, and hectic, are removed by anticipation.

Certain circumstances are usually understood to render the performance of primary amputation either essential or expedient. 1. When a limb has been carried away, leaving a shattered stump. To refrain from amputation in such a case, were willingly to encounter immediate risk by gangrene; subsequent danger, by hectic, under a wasting and long protracted suppuration; and certainty of the stump, even when healed, proving unserviceable. 2. When a limb has been struck by shot, and shattered, although not carried away; when bones are broken, blood-vessels and nerves torn, and muscles bruised to disorganization; gangrene is inevitable, and operation imperative. 3. When a mass of the soft parts has been carried away, involving the principal vessels, yet without injury to the bone; or when, the main vessels remaining entire, the rest of the limb is hopelessly shattered and bruised; still gangrene is certain, and amputation demanded. 4. When the part is crushed to disorganization, without wound of the integument; as by a spent shot; a state evidenced by the pulpy, loose feel, coldness, and impaired sensibility of the part. 5. When joints are opened, and the bones composing them broken. This applies specially to the lower limb. In the upper there is a much greater tolerance of injury, as well as power of repair. In both extremities, but especially in the upper, resection of the joint often supersedes the amputation of the limb, when the injury is limited almost exclusively to the articulation. 6. Compound fractures of the thigh, more especially at its upper part, are usually found to proceed untowardly; and, therefore, the majority of such cases are held to demand primary amputation.

However plainly the local injury may render amputation necessary, it is obvious that the operation should not be performed unless there exist a reasonable prospect of success. For example, if a patient be mortally wounded in an internal organ, besides having sustained severe injury of a limb, it were sad surgery to shorten as well as embitter his doomed life by the pain and exhaustion of an operation directed towards the lesser evil.

Secondary amputation becomes imperative, in the case of a limb which we had hoped to save, when spreading gangrene occurs, when secondary hemorrhage sets in, when the loss of bone by necrosis, or of the soft parts by sloughing, is so extensive as to render consolidation and the retention of a useful limb hopeless, or when the frame is obviously yielding under an otherwise uncontrollable hectic. A *second* amputation may also be rendered expedient, when the stump which

resulted from the first operation proves unsatisfactory ; in consequence of sloughing or ulceration of the soft parts, or very extensive exfoliation of the bone.

The occurrence of tetanus may, under some circumstances, perhaps, be held to warrant amputation ; if so, the operation should be performed at an early period of the disease.

In almost all the surgical operations and manipulations connected with gunshot wounds, the use of chloroform is of vast benefit ; not only assuaging pain, but also modifying the condition of shock, and so imparting to the system a greater tolerance of the operation, both present and prospective.

TETANUS.

This is a disease of the true spinal nervous system ; the cerebrum being unaffected, or only implicated at a very advanced period of the case, when delirium or stupor may supervene shortly before death—as in many other affections primarily unconnected with the cerebral centres. The characteristic symptom is true tonic spasm and permanent rigidity of the voluntary muscles. According to the extent and predominance of the muscles affected, various terms are applied in connection with this disease. When, *e.g.*, the muscles of the neck and face alone are involved, fixedness of the jaw is the most prominent symptom—hence the vernacular term of Lock-jaw—and this condition is technically called *Trismus*. When the muscles of the back are chiefly affected, bending the body backwards, like a bow, until in extreme cases the resting points are the heels and occiput, it is said to be a case of *Opisthotonos* ; while *Emprosthotonos*—of infrequent occurrence—denotes the opposite condition, characterized by predominant affection of the muscles on the anterior aspect of the trunk. Bending to either side is termed *Pleurothotonos*—a very rare form of the affection. Strictly applied, the term *Tetanus* denotes involvement of all classes of muscles, without preponderance of action in any ; whereby the body is rendered rigid and straight. The ordinary use of the word, however, denotes the disease in general, and includes all its varieties.

Whatever form occurs, the access and progress of the disease may be either *Acute* or *Chronic* ; the former a very formidable malady, seldom admitting of cure, tending to involve the whole frame, and unfortunately the more frequent in occurrence ; the latter milder in all its phases, more inclined to be partial, and much more amenable to treatment. The disease is also said to be either *Traumatic* or *Idiopathic* ; the former following wound, or other injury, and usually acute ; the latter of spontaneous origin, without any external and assignable cause, and usually chronic.

The most frequent form is that which is traumatic and acute ; and the symptoms and character of this may be taken as typical of the disease in general. It is more frequent in hot climates than in temperate ; in military than in civil practice ; in children and the middle-aged, than in youth and the far advanced in years ; and according to some authors, in men than in women. The existence of a wound is not essential ; it has

followed simple fracture, and a blow or bruise—even apparently slight. It has also followed a mere fall, without any apparent bruise; and it has been induced by the unsurgical operation of tooth-pivoting. Wounds, however, are the ordinary exciting cause; especially those of a punctured and lacerated kind, inflicted in dense textures well supplied with nerves—as the fingers and hand. There is good reason to believe, in some instances, at all events, that injury done to some individual nervous branch is prominently connected with accession of the symptoms; that it has been punctured or torn, or partially divided, or included in a ligature applied to a bleeding artery; or that it is continually excited and injured, by some rough or sharp foreign matter lodged in the wound.

The predisposing causes of tetanus are not easily ascertained. But it seems quite certain that intestinal and uterine irritation, especially the former, act in this way; as also exposure to atmospheric vicissitude and malarious influences. And these, again, which rank as predisposing causes, when a wound is the exciting cause, may, when there is no breach of surface, become themselves exciting causes of the idiopathic form of the disease.

The period of accession varies. In some cases the symptoms appear within a few hours after infliction of the injury; in others a few days elapse, and the accession is while symptoms of acute inflammatory progress are present in the wound. More frequently, cicatrization is nearly complete; and in such cases it has been supposed that the exciting cause is a neuromatous formation in the injured nerve, which has become entangled in the dense cicatrix, and is thereby irritated. Certainly, such a morbid condition has been met with in tetanic cases; more especially when following burns. When three weeks have elapsed, without any threatening of accession, the patient may usually be considered safe. Whereas, in hydrophobia, it will be remembered, invasion is seldom till even a more distant period.

In Tetanus there is a peculiarly “excitable state of the Spinal Cord and Medulla Oblongata, not involving the ganglia of special sense. This may be the result of causes altogether internal, as in the idiopathic form of the disease; in which the condition exactly resembles that which may be artificially induced by the administration of Strychnine, or by its application to the cord. Or it may be first occasioned by some local irritation, as that of a lacerated wound; the irritation of the injured nerve being propagated to the nervous centres, and establishing the excitable state in them. When the complaint has once established itself, the removal of the original cause of irritation (as by the amputation of the injured limb) is seldom of any avail; since the slightest impressions upon almost any part of the body are sufficient to excite the tetanic spasm.”*

The nerves concerned in mastication and deglutition are generally first involved; and the obedient action of the muscles produces distortion of the mouth, with a feeling of sore throat, and some degree of pain and stiffness in the neck and jaws—usually the first symptom. If the orbicularis oris predominate in action, the mouth assumes a puckered appearance; more frequently the antagonist muscles are in the ascendant,

* Carpenter's Physiology, p. 517.

causing a ghastly smile. Dryness and soreness of the mouth are felt ; swallowing and mastication are difficult ; the neck becomes more and more rigid ; and attempts to swallow—fluids especially—are apt to induce convulsive efforts, perhaps threatening suffocation. Ultimately, the jaw becomes firmly closed ; the masseters and temporals feeling hard and bulging. All the muscles of the face are involved. The forehead is much wrinkled, both longitudinally and transversely ; and the eyebrows, by the action of each corrugator supercilii, are closely approximated, forming a sharp angular curve at their inner and highest part. The eyes, usually, are not fully opened ; the orbicularis and levator seeming almost to neutralize each other. The eyeballs are distorted, and fixed. The nostrils are dilated. The angles of the mouth are drawn much backwards, and (the elevators predominating over the depressors) are somewhat elevated. The orbicularis oris binds the lips firmly on the teeth ; which, however, are now always more or less seen. The expression (*Risus Sardonius*) is indicative of much suffering, and quite peculiar to the disease ; it may indeed be said to be pathognomonic. The marked change of countenance has not been long assumed, when a distressing pain occurs at the lower part of the sternum, shooting backwards in the direction of the diaphragm ; accompanied by spasms of that muscle, impeding and disturbing respiration. This is the first of the involuntary muscles which is affected. They now, however, become more and more involved. The spasms are more intense ; sometimes remitting, even to a considerable extent, but never undergoing complete intermission. Exacerbation is induced by the slightest external cause. In general, the whole body becomes fixed and rigid ; occasionally distorted by convulsive movements. The abdominal muscles are especially affected ; the recti have sometimes been torn by the violence of contraction. The arms usually are the last disordered ; and the fingers sometimes continue mobile to the last. The tongue, too, remains long free ; when affected, it tends to protrude between the teeth—if the muscles of the jaw undergo temporary relaxation—only, however, to be bitten by them during the next access of spasm ; then bloody saliva trickles from the grinning mouth, fearfully aggravating the already horrible expression of countenance. The sphincters are usually contracted. The bowels are obstinately constipated ; partly from the cause just stated ; but mainly from inherent derangement of the functions of the whole alimentary system. When movement is obtained, matters much changed from the normal state, and of remarkable foetor, are passed in great abundance ; shewing great derangement of the intestinal canal to be a marked and invariable symptom. And, as already stated, this derangement may also, with much probability, be considered as connected with the origin of the disease. There is difficulty in passing water, from spasm of the muscular fibres at the neck of the bladder, and in the perineum ; occasionally there is marked relaxation of these, during which the *detrusor* may squirt forth the urine with much force. Intense pain accompanies the spasmodic exacerbations ; and there is generally a profuse perspiration from the whole surface, sometimes emitting a peculiar and pungent odour. The pulse at first may be both strong and full ; but it soon falls from the sthenic type, becoming rapid, weak, and indistinct. No delirium, or other apparent

disorder of the cerebral function, occurs, until shortly before death. As in hydrophobia, the patient perishes either by asphyxia, during a spasmodic paroxysm; or of exhaustion, during a period of remission; most frequently in the latter mode. It is also possible that death may occur suddenly, from the muscular fibres of the heart having become rigidly contracted. The duration of the disease is seldom beyond a few days, in the acute form. The chronic may continue for more than a fortnight; and then there is usually recovery.

The morbid appearances found after death are similar to those in hydrophobia; and, likewise, are far from uniform or satisfactory in their nature. The brain seldom shews aught amiss; unless it be an unusual amount of serum. The spinal cord usually evinces manifest congestion, both in itself and in its membranes; more especially at the origins of the nerves; and the amount of serum may be preternaturally and considerably increased. The lungs are congested: there is unusual vascularity of the air passages, and of the pharynx, œsophagus, and stomach; and sometimes these canals retain a diminished calibre, the spasmodic contraction having not yet ceased in death. The nerves at, and leading from, the injured part, usually shew increased vascularity, enlargement, and other signs of the inflammatory process, either chronic or acute. None of these changes, however, is of such a prominent character as to enable the morbid anatomist to recognise that tetanus had been the cause of death, unless he had been made aware of the history of the case.

In the traumatic form, it is in the nerves of the part that inflammatory change might be expected to occur, rather than in the spinal cord; for the disease in such case might naturally be regarded as merely an extreme example of *Irritability* in the whole true spinal system, induced by irritation of some kind or other in some portion of its periphery. The spinal ganglionic centres, no doubt, possess an increased susceptibility of response to external impressions; but this we might imagine to be produced by a degree of vascular change secondary to the peripheral, and altogether less appreciable, and minor in amount and degree. By some, however, a poisoned condition of the blood has been supposed to account for the tension of the spinal system of nervous centres during the existence of the idiopathic form of the disease, and in the traumatic as well. Such a theory in explanation of the facts would not imply the existence of any such excessive source of peripheral irritation as the other view, but only such an hyperæsthetic condition or increased sensitiveness of the spinal ganglia, as undoubtedly exists in certain conditions; as, *e.g.*, poisoning by strychnine, which closely simulates the tetanic state. The poisonous material has by some been supposed to originate in the wound; by others to exist in the unwholesome air, or atmospheric exposure by which the patient is surrounded.

No doubt Myelitis, where we have the inflammatory process in the medulla spinalis inducing symptoms of a tetanic character, is always accompanied by a change of structure in the medullary substance, more or less marked, and always easily appreciable. But this is accompanied by symptoms of an inflammatory kind throughout, and in other respects is altogether different from true tetanus.

Poisoning by strychnia most closely simulates the disease; diagnosed,

however, by the narration of the case, the sudden onset of the symptoms, and the intermittent manifestation of them according to the repetitions of the poisonous dose—or their rapid fatal advance, in the case of a single dose sufficient to destroy life.

Hysteria sometimes achieves a very close simulation. And yet it is capable of being readily distinguished by the careful observer; spasm and rigidity being more decidedly paroxysmal, possessing periods of complete intermission, and evidently being to a great extent within control of the patient's will; also, the ordinary signs of hysteria are present, usually in a distinct and prominent form.

Treatment.—Prevention is likely to be accomplished:—in the first place, by avoiding the class of wounds most prone to prove prejudicial in this way; in the second place, and mainly, by adopting the simple, non-irritating treatment of all wounds, such as we have endeavoured to inculcate. The disease having occurred, the indications of treatment resolve themselves into those which regard the part, and those which regard the system.

As to the part. Amputation has been proposed and practised, but with very indifferent success. It can only be of use at an early period of the case, as already observed. The result of my own experience is favourable to the minor operations; unfavourable to the larger. Unless excessive pain in the limb, or some urgent state of the part itself (as sloughing, infiltration, hemorrhage), rendered its removal necessary, I should not feel warranted in performing any of the greater amputations, in the hope of relieving tetanus.

Incision, made to surround the part on its cardiac aspect, deep and wide enough to cut off all nervous communication, is plausible in theory; and experience already has spoken somewhat in its favour. It is a simple and safe procedure, and may often be practised when amputation cannot. For the latter operation, at an advanced period of the case, is in no circumstances warrantable; the shock and loss of blood being certain to accelerate the fatal issue. Should any painful operation be deemed expedient, the use of anæsthesia will be especially productive of good in this disorder, as can be readily imagined; not only relieving pain and shock, but also saving the nervous system from otherwise highly injurious excitement.

The actual cautery is by some recommended for the wounded part; by those who imagine that some poisonous material generated in the wound by absorption produces the symptoms. Its use has not been attended by success. On the contrary, the treatment there should surely be of the bland and soothing kind; as water-dressing, or light poultice—hot, and medicated by sedatives, as opium or belladonna; incision, however, being never withheld, to relieve tension, evacuate abscess, or arrest diffuse infiltration—when such indications require to be fulfilled.

As to the system. Bleeding, in genuine tetanus, is not expedient. If used at all, it must be early, and with a sparing hand; and, as in hydrophobia, rather as an adjuvant to other remedies than itself a means of cure. Purging is essential at the first, as can readily be understood; there is much filth to be dislodged from the interior, and much depravity of the intestinal secretion to be corrected. Croton oil, elaterium, or

calomel, occupying little bulk, may be got over without much difficulty ; and may be repeated, till the bowels respond freely to their use. When once, however, the bowels have been thoroughly unloaded, and the noxious accumulation cleared away, all purgatives are to be abstained from. Besides exhausting strength, their irritation can only do harm ; and their place will be well supplied by enemata, sometimes bland and nutritive, sometimes stimulating, and more particularly terebinthinate. Purgation over, the attention is naturally directed to the most powerful of the sedative remedies ; and of these the disease generates a remarkable tolerance. Opium has been given in large quantity ; but in the solid form it proves comparatively inert ; lodged, little altered, in the stomach—the function of digestion being probably much in abeyance. Lately it has been proposed to administer it in the form of fume, *à la Chinois* ; an expedient not irrational, and worthy of trial. Belladonna has been given in large doses ; one, two, three, or even four grains of the extract every two hours ; and frictions, with the tincture, over the affected parts, sometimes have seemed to afford relief. But this and all other medicines, in this disease, should be given in the fluid form, in order to favour their activity as far as possible ; and the mode of administration may be either by the mouth, or injected beneath the skin. The *Cannabis indica* has, in warm climates, greatly alleviated the symptoms ; and, in some cases, seems to have contributed powerfully towards cure. In this country, its success has not hitherto been so great ; and yet such as fully to warrant further trial. My own experience speaks highly in its favour. It is given in doses of thirty drops of the tincture ; repeated every half hour, hour, or two hours ; the object being to produce and maintain gentle narcotism.

Tobacco is a most powerful sedative, administered in the form of enema ; a drachm to the pound of water, and the half given at a time, with repetition according as circumstances may demand. Let it never be forgotten, however, that this remedy may readily become a formidable poison ; and that large doses, or reckless repetition of even small quantities, may wholly prostrate the powers of life, and carry off the patient. Each dose must be cautiously given, and its effects carefully watched, and while with the tobacco we endeavour to allay nervous excitement and muscular spasm, with nutriment and stimuli we sustain the powers of life ; finding this combination of a sedative with stimulus not only expedient but essential. The warm bath has a relaxing effect on the muscular system ; and this is much enhanced by medication of the water with antimony ; from two to six drachms of the tartrate of antimony being dissolved in an ordinary bath. The remedy, however, requires care, like the tobacco ; lest it prove excessive.

The Wourali poison is esteemed the most direct, powerful, and simple of sedatives ; an animal poisoned by it “sinks from existence in the most placid swoon.” The nervous system is chiefly acted on ; and, after apparent death, from cessation of nervous function, the heart’s action may be continued for some time. When no large quantity of the poison has been administered, artificial respiration—maintaining the heart’s action—will sustain life ; until the poisoning influence has passed away, and the nervous system has rallied from its temporary paralysis. At one time

was supposed, naturally enough, that such complete rest given to the previously racked spinal system, even though of short duration, might be followed by the best curative effect; that on resumption of nervous function, the tetanic symptoms would be found to remain partly or even altogether in abeyance; and that either an immediate exemption from the symptoms, or palliation and a partial approach to cure, might thus be obtained. The proposed mode of application to the human subject was to insert a small quantity of the poison into a puncture of the hand or arm; regulating its introduction into the system, and its effects there, by tightening or relaxing a ligature on the cardiac aspect of the wound. Experiments on the lower animals, however, have resulted only in disappointment; and the application of this remedy to man is now scarcely warrantable.

From what is now known of the effects produced by the Calabar bean (*Physostigma*), the use of its tincture seems to hold out a prospect of relief, by advantageously obtaining the same depressing influence upon the spinal ganglionic centres as has been attempted to be effected by the wourali, or as follows the use of conium when given in almost poisonous doses. In such circumstances doses of ten minims may be given every hour or two hours; carefully, however, watching its effect, and diminishing or stopping the dose if the degree of depression of the circulation should become too great.

The breathing of chloroform relaxes spasm and annuls suffering, for a time. And the use of this wondrous agent has certainly contributed, if not to the cure of tetanus, at least greatly to alleviation of its symptoms.

Counter-irritation over the spine, with the endermic use of sedatives, may do good. Morphia may be sprinkled on the raw surface—or injected beneath the skin—or aconite, or belladonna; and for the same reasons as stated in the case of hydrophobia, probably aconite may be the most hopeful of the three. Or cold may be applied continuously to the spine, especially to its upper part; its effect being narrowly watched, lest it prove excessive; stimuli and support of the general system being at the same time given, as in the use of tobacco.

Mercury, pushed to ptyalism, has seemed to effect cures in hot climates; in this country it has proved less successful. Lately, the subnitrate of mercury, in doses of ten grains, has been strongly recommended. Its effects are purgative, emetic, and diaphoretic; and the spasms are said to relax greatly, when these results have been obtained.

Throughout the whole period of attempted cure, the utmost quiet and seclusion should be observed; all noise, light, and prying visitors being excluded. Nourishment should be given, to as full an extent as circumstances place in our power; by the mouth, if possible; by the rectum; and by the skin. By nutritive enemata and baths, life may be prolonged for some considerable time after the power of swallowing has gone; and—as bearing upon this point—it is to be remembered, that the greater number of patients usually die of exhaustion.

On the whole, I should be inclined to arrange as an eclectic constitutional treatment:—absolute quiet and seclusion; purgatives, to clear thoroughly the primæ viæ, afterwards stimulant enemata as required;

nourishment given often, in small quantities ; cold to the spine, by ice in bladders—applied constantly, if not proving over-sedative ; Indian hemp, *pushed*, so as to maintain moderate narcotism ; inhalation of chloroform, employed cautiously and occasionally, to alleviate paroxysmal accession.

In chronic tetanus, the principal remedies are purgatives, and turpentine enemata, continued until a satisfactory result has been obtained upon the intestinal canal ; support, by nourishment ; and gentle use of the antispasmodics. Heroic remedies are neither necessary nor expedient ; recovery being as common in this, as it is rare in the acute form. After the tetanic symptoms have subsided, tonics are necessary, along with support ; to remove the state of debility which tends to remain.

CHAPTER XXI.

OF BURNS AND SCALDS.

BURNS and SCALDS denote injury done by excessive heat ; applied in the former, by radiation, by flame, by molten metals, or by solids ; in the latter, by heated fluids or vapour. Those inflicted by flame, heated oil, and steam, are the most severe ; the temperature and intensity of combustion being great, or—as in the case of steam—the extent of surface acted on being usually very considerable.

The dangers of this form of injury are various ; even to a greater extent than wounds, they are not mere casualties happened to a part. 1. There is a shock imparted to the system, when the burning is extensive and severe, or involves an important part ; and under this shock the patient may perish, by syncope. 2. Imperfect or nervous reaction may result, to an excessive and uncontrollable degree ; the patient sinking exhausted, under febrile tumult of the asthenic kind, at a very early period. Sometimes a deceptive lull precedes this form of reaction. An elderly patient, badly burned, may walk to hospital, and yet be dead in forty-eight hours. 3. Or reaction of the sthenic type proves excessive ; and under the violence of inflammatory fever, life may be endangered. 4. During the progress of inflammatory fever, the internal organs, more especially the lungs, are apt to suffer ; seriously complicating the case. At a more advanced period, fatal disease of the intestinal mucous coat may occur. 5. More remotely, tedious cicatrization, confinement, and discharge, are prone to peril the system by hectic. Death escaped, life may be rendered very miserable, by the deformity and impairment of function often inseparable from healing of the burn.

The risks of burns and scalds, therefore, practically depend, 1st, upon the extent of surface implicated ; 2d, upon the degree or depth of the injury inflicted upon the parts affected ; 3d, upon the age and strength of constitution of the individual who has sustained the injury ; and 4th, as we shall see, in no small degree upon the site where the injury has been sustained.

The classification of burns and scalds, at once most natural and most useful, is according to the degree to which the textures have sustained injury. I. The mere surface is involved, by a slight and temporary application of heat ; usually in the form of fluid or steam. A mere erythema results, usually terminating in resolution ; but not without risk, when occurring in the scalp, chest, and abdomen, when including any considerable extent of the surface, and especially when affecting a child of tender years or an individual who has attained the other extreme of life. II. The cutis undergoes the inflammatory process of a higher grade. Pain, swelling, and tension, are followed by vesication ; and the vesicles

may either suppurate, or disappear by desiccation. The heat may have been applied either in the fluid, or in the solid form. In the latter case, it is not uncommon for the cuticle to adhere to the heated substance; then no vesication forms, but, instead, a raw surface is left of exceeding tenderness, which speedily inflames and suppurates, and probably is extended by acute and painful ulceration. This circumstance, occurring accidentally, well illustrates the importance of retaining the cuticle unremoved, and, after evacuating the serum, preserving it as little disturbed as possible, in those cases which are under treatment with vesications already formed. III. By a greater application of heat, in the solid form, or by flame, the external part of the *cutis vera* is cauterized; killed immediately, or almost so; and converted into an insensible slough, of a darker or lighter colour according to the rapidity with which it has been made to part with its vitality. Though the surface be insensible when lightly touched, yet acute pain is elicited by pressure. If the part have died instantly, there is no change in its character; it is at once an eschar, and remains so, until detached. But when its death has been subsequent to the injury, and a gradual although still a rapid process, dark vesications may form, as in ordinary gangrene. After separation of the slough, the pain which had almost ceased shortly after infliction of the injury, is renewed, of a very intense character; in consequence of the sensitive cutis, which had been but half destroyed, now constituting the raw and inflaming surface. This, in truth, is the most painful of all burns; and, as formerly observed ought to be avoided, when such injuries are inflicted by design with a curative object in view. By gunpowder this burn is often produced and, in such cases, the surrounding skin is begrimed by lodgment of the grains. IV. The skin is wholly cauterized; at once converted into the state of eschar, dark coloured, dry, and insensible. The dead portion contracts in its change; and, consequently, the surrounding integument presents a puckered appearance, so long as the eschar remains adherent. Pain is acute during the burning, but soon subsides; and, for a time is almost entirely absent. On inflammatory accession, necessary for detachment of the eschar, pain returns; but not of the inordinate degree which invariably attends the like stage in the preceding class of injury. This is the form which it should be our object to produce in using the actual cautery. V. The cauterization extends deeply; producing a sonorous, black, brittle, and depressed eschar, more or less extensive; slow in separating, and followed by much suppuration; forming a wound very tedious in its progress towards cure. And the cicatrix is usually of an unsatisfactory kind when obtained. VI. The entire thickness of a limb is reduced to the state of eschar; and removal by amputation is demanded. The spontaneous separation is slow; besides, the stump cannot heal, and the system is under much danger by protracted hectic. These different degrees of burn are divisible into two classes according to their result. The first three, dangerous from extent rather than serious from local intensity, and not followed, should the patient recover from the risk which immediately follow the infliction of the injury, by any serious deformity. The last three, again, are rarely extensive, but usually very serious from the inevitable deformity which must occur should cicatrization become complete.

In general, these various degrees of burn are more or less blended ; the greater including all the lesser. For example, in the centre of a burnt part, where heat has been most intensely applied, there may be the depressed eschar ; exterior to that, the skin only in part destroyed ; beyond this, the skin alive, and about to be actually inflamed ; and, exterior to all, such an amount of injury as will produce but an erythema. The most severe examples of the injury are usually those caused by flame, as when the clothes have taken fire ; for the part is made to contribute towards its own combustion ; and this is intense and rapid. And these cases are always formidable, even if no deep destruction of texture have occurred at any part ; by reason of the extent of surface affected, and terror greatly augmenting the shock—circumstances both tending to produce much internal congestion in head and chest—which afterwards reacts unfavourably. Hence prognosis must always be guarded. In considering the agents which usually produce certain degrees of burn or scald, there are exceptions which it is well to recollect ; *e.g.*, although boiling water and steam usually confine their effects to the first three degrees of scald, that is only because the application of these agents is usually very temporary. A part may be deeply destroyed by being kept for some seconds in boiling water ; and the continuous play of high pressure steam, as it expands into aqueous vapour, will in a very brief space of time destroy not only the surface of the *cutis vera*, but actually *boil* the textures to a considerable depth.

As regards prognosis, it is important to remember, that loss of substance often proves more extensive than it at first seemed. A part dies immediately ; but another, and sometimes a larger portion, perishes subsequently, under the inflammatory process ; the heat was insufficient for immediate extinction of its vitality, yet lowered this so far as to render it unable to withstand even the ordinary inflammatory change which invariably ensues. And, thus, the immediate eschar may come to appear insignificant, in comparison with the subsequent slough, and the hiatus left after its separation. In cases suspected to be severe, it is always a favourable sign to find vesications form ; denoting that the part still retains at least a certain amount of vitality. Prognosis is further dependent, not only on the extent of injury, but on the previous state of the patient's system, and on the nature of the part to which the injury has occurred. Burns are most dangerous on the head, neck and trunk ; as also those which affect the genital organs, at a tender or advanced age.

The constitutional symptoms have already been noticed. There is first the shock or state of depression, usually accompanied with more or less internal congestion of the brain and its membranes, of the lining membrane of the respiratory tubes, and of the same tissue in the intestinal canal. From this condition reaction takes place, of either a sthenic or an asthenic kind ; usually the former, unless the accident be very severe, or the system previously much enfeebled. Then comes inflammatory fever, more or less violent, accompanying the inflammatory process which necessarily ensues in the part. About this time—the end of the first, or the beginning of the second week—the constitutional symptoms are apt to become unpleasantly complicated, by evidences of acute affection of

the internal organs. The lungs are prone to suffer, by inflammatory affection of the bronchial membrane ; and also by engorgement of the pulmonary tissue. Subsequently effusion may occur in the pleural cavity. The mucous lining of the duodenum is apt to ulcerate, usually at a little distance below the pylorus. The ulceration is round and limited ; sometimes single, sometimes in patches. After a time, contraction and cicatrization may take place ; more frequently perforation occurs, and the result is fatal. A third complication is possible ; the brain and its membranes, that were congested at first, may become the seat of cerebral softening and serous effusion. This, however, is usually at a later period, and accompanies very frequently symptoms of Pyæmia.

The inflammatory stage having passed, the symptoms abate ; if the sore left be slight, and the progress towards cure satisfactory. Otherwise, hectic sets in ; and, in the more extensive and protracted cases, this in its turn gives way to confirmed collapse. The extremes of age—childhood and senility—are more liable to suffer untowardly than adolescents and adults ; as can readily be understood.

Practically, the injury and its results may be divided into three stages. 1. That of shock, with internal congestion, followed by reaction, perfect or imperfect. 2. The inflammatory, with its complications, by affection of the internal organs. 3. The reparative, ending either in granulation, contraction, and cure, or in wasting suppuration, hectic, and collapse—or, it may be, death from pyæmic infection, or the induction of tetanus.

The process of cure is uniformly tedious. A portion of the burnt part usually dies ; either immediately, or subsequently, under inflammatory excess. This must be detached ; and ulceration accordingly supervenes. On subsidence of this, reparation is begun ; at first energetically enough ; but the effort soon flags, and progress is slow and uncertain. The injury has effectually impaired the vital power of those parts on which the burden of the reproductive effort is thrown ; and they are not equal to its efficient support. Besides, there is much loss of substance ; the production of new matter to fill the gap, as has been stated, is always very scanty ; the healing result is, in consequence, mainly to be effected by extension of the surrounding cutaneous textures produced by contraction of the cicatrix ; and, whenever there is a large extent of surface to heal in this way, a long time is always required to do it. But, besides the fact that contraction and cicatrization of the sore produced by burning is always tedious, from the same cause there is also a proneness to produce deformity. For, by contraction of the original textures, much displacement in the relations of neighbouring parts is likely to ensue ; all the more, in consequence of such contraction not ceasing on cicatrization being completed, but continuing for some time afterwards. So much have the reproducing parts had their powers weakened, they not only form little new substance, and leave the greater part of the closure to contraction of the original textures ; but the little new which is produced is imperfectly organized ; and, consequently, like all similar adventitious structures, it is prone to disappear, or at least to diminish, by absorption. The peculiarities in the healing of burns, then, may be shortly stated to be : that they heal slowly, and

much more by contraction of the old structures than by the formation of new ; the new matter is imperfectly organized, and liable to absorption ; and, consequently, contraction continues, for some considerable time after apparent completion of the cicatrix. Exceptional cases there are, no doubt ; where either the old tissues have been less destroyed, or the new matter is thrown out in excess, forming large, dense, unseemly elevations of the cicatrix.

Treatment.—No class of injuries has been more the subject of empirical treatment than burns, even in the profession. And yet the indications can be laid down, as plainly as in any other affection. 1. *Assuagement locally.* The smarting pain of even a slight burn is not easily borne, and the sufferer seeks anxiously for relief. If he be seen immediately after the infliction, and the extent of injury be small, there is nothing better than instant immersion of the part in cold water ; where it is to be retained, not for minutes, but for hours ; the temperature being kept continuously low, by additions, as circumstances may require. Or the cold may be applied by means of water or ice in bladders. A doubly beneficial result is obtained. The heat and pain are mitigated, and, at the same time, the inflammatory process is held in abeyance ; in the slighter cases, it may never occur ; in the more severe, its attack will be less violent than it otherwise would have been. Afterwards, it is our principal object to prevent the contact of atmospheric air ; the stimulus of which would certainly induce, or aggravate, inflammatory accession. In the slighter cases—those of the first class, and a few of the second—we hope to avert suppuration altogether, and to obtain cure by resolution, with or without vesication, and certainly without the formation of ulcer or secretion of pus. After discontinuance of the cold, therefore, the part must be protected in some way from without. By some carron oil (equal parts of lime water and olive oil) is extolled, by others flowers of sulphur, with sulphur ointment, is considered a panacea. Some advise that the surface should be coated by a layer of some bland adhesive substance, which will not irritate the raw or injured surface, and yet will effectually exclude the air ; as soap, gum, goldbeater's skin, or varnish. Gum Tragacanth is probably the most suitable, as recommended for unclosed wounds ; it is certainly bland ; with ordinary attention can be kept perfectly protective ; and has the advantage of permitting the condition of the part to be observed, almost as well as if it were wholly uncovered. Others advise the part to be dusted over with starch or flour ; but, when vesication is expected, this, like the others just mentioned, is an objectionable form of protection ; inasmuch as the serum bakes it into crusts, which crack, loosen, and are apt to irritate. But, better than anything else, the tender part should be carefully enveloped in a thick layer of soft, cleaned, cotton wadding, which is retained by gentle but firm bandaging. In such circumstances, before applying the cotton, when vesicles exist, especially when large, they should be punctured or clipped, to permit free escape of their contents ; so relieving tension. But especial care should be taken not to ruffle or displace the cuticle, still less to remove it ; for it is certainly the most intimate and the best protector of the tender surface beneath. To prevent the cotton wadding from adhering when the serous

oozing escapes, the simple—the oxide of zinc—or the sulphur ointment, spread on strips of lint, should be laid over each aperture ; and this will be found a much better plan of procedure than soaking the whole wadding, or irregularly smearing the surface, with carron oil. 2. *Calm and restore generally.* The state of depression must be watched in the first instance, and nothing done to favour its continuance. On this account, when a burn or scald involves a large part of the surface, the continuous use of cold cannot with propriety be had recourse to. Under such circumstances, a warm solution of opium, or other anodyne, is preferable, for assuaging pain. When the duration and degree of shock threaten to prove excessive, restoratives must be employed ; as heat to the general surface, and warm drinks internally ; followed, if need be, by wine, ammonia, or other stimulants. If reaction prove premature and asthenic, it must be moderated by opium or other calmatives. And opium is often useful, from the first, in full doses, to relieve the great suffering, which otherwise must tend to prolong and aggravate the condition of shock. When, however, the absorbent surface is extensive, especially in the case of children, its effects as a lotion should be watched, for they may become serious. When also the extent of burn is great, and more or less persistent somnolence accompanies it from the commencement, the use of opiates is fraught with danger ; as thereby, by what would otherwise be small doses, fatal coma with a contracted pupil has been occasioned. 3. *Keep antiphlogistics in view.* When stimulating to overcome the shock, the coming sthenic reaction must always be remembered. And, while we prevent sinking, we are to be careful not to expedite and aggravate the impending inflammatory attack. 4. *Promote separation of the sloughs.* For this, poultice, or warm water-dressing, are the suitable applications. A certain amount of ulceration is essential for detachment ; and under these epithems it advances favourably. For the severer burns, cotton, gum, soap, and varnish, are manifestly unsuitable ; the first, especially, would speedily become soaked with discharge, and either require frequent renewal, or else prove a very hot-bed of putrescence. It may happen, occasionally, that the central portion of the eschar is detached at an earlier period than the margins ; and pus, accumulating beneath the detached part, does harm to the inflaming and ulcerating textures beneath. Under such circumstances, the elevated and tense dead portion—the least pressure on which produces much pain—is to be freely cut through by a bistoury. 5. *Limit the inflammatory process.* A certain amount of this is necessary, to separate dead and dying parts from the living, and to originate the subsequent process of granulation. But we desire no more than what is essential. The part is kept at rest, in a suitable posture ; and is fomented and poulticed, or enveloped in the water-dressing ; the detached skin, now containing purulent fluid, and no longer acting as a protecting agent, being carefully and completely removed with scissors. Antiphlogistic regimen is enjoined, in moderation. The bowels are kept open, and perhaps aconite is mildly exhibited. In the more urgent cases—more especially when inflammatory affection of the chest exists—even a moderate bleeding may be taken from the arm. But all this must be done with caution, sparingly and grudgingly ; for we know full well that every

available resource of the system will by and by be called upon, during the protracted period of granulation and probable hectic—and that even at the time the system is not in a state favourable for the bearing of heroics. 6. *Promote granulation.* So soon as the inflammatory process has sufficiently subsided, water-dressing is applied; not hot, but tepid, as a mere detergent and protective; and this is continued, so long as the granulating surface remains of a healthy and vigorous character. Such period is but a short one, however; the sore soon assumes the weak character; requiring medication of the dressings, by various stimulants; as the salts of zinc, copper, iron, silver, etc. At the same time, early support by bandaging is usually expedient. By some, a weak solution of the chloruret of soda is held in much repute as an application from the first; but this seems to be its proper place; and, in this place, I can testify from experience to its efficacy. If there is much foetor, a weak dilution of Condry's disinfecting fluid suits admirably. 7. *Regulate the degree and direction of cicatricial contraction.* And remember that centripetal movement of the old textures does not cease on cicatrization. The parts implicated in the injury, mediately and immediately, must be placed in their proper relative position; and should be retained so, by suitable retentive means, during the whole period of cure. For example, in burns of the neck with loss of substance the head must be placed and kept erect by bandaging; otherwise the chin will be drawn down upon the sternum, and frightful deformity will ensue by traction of the facial integument (Fig. 209). In less extensive injuries, on the face, arms, or other exposed parts, strips of adhesive plaster may be so arranged as to moderate the centripetal movement. This opposition, however, must never be carried so far as to peril the frame by hectic from tedious cure. When orifices of canals are implicated—as the nares, urethra, rectum—they are to be kept distended by plugs or bougies, until the period of contraction has gone by; in order that the normal calibre may be retained. When opposing surfaces are implicated, as in extensive burn or scald of the fingers, abnormal union is to be prevented by the daily and careful interposition of dressing; and it is well, at the same time, to maintain a considerable pressure at the points of commissure. 8. *Retain the functions of joints.* This is effected by passive and frequent motion. But, sometimes, the parts exterior to a joint are so wholly involved by the injury, as to render it obviously impossible to fulfil this indication. The joint must become stiff, by a kind of spurious ankylosis. And we have in these cases to content ourselves with securing such a position of the stiffening part, as shall afterwards prove most serviceable; the elbow, bent at right angles, or something more; the knee almost straight. 9. *Maintain the powers of the system.* This is done by attention to air, exercise, and clothing; by generous diet; by the use of tonics and stimuli; and of the latter, cantharides is often a most efficient form. A view towards this indication must always pervade our fulfilment of the fifth. 10. *Remedy deformity.* In spite of all efforts to moderate contraction, and to maintain due relation of position, deformity is of frequent occurrence, when much loss of substance has been sustained. A simple incision may sometimes suffice, when the treatment has been negligent. Mere division of a tight cicatrix may permit the parts to be normally re-

adjusted ; and then, the proper retentive means being employed, a better healing may be obtained. Or, by means of a subcutaneous wound, a depressed and adherent cicatrix may be set free. But perhaps there has been no faulty treatment ; everything has been done to prevent displacement, and yet it has occurred. Or it may be that, to save the system and obtain a cure, the moderating means have been less energetically employed towards the close, than at the first. In short, there has been much loss of substance ; and the part could not have healed at all, without very considerable contraction of the old textures. In such cases, the deficiency must be supplied. By incision, the cicatrix is completely divided ; the parts are replaced in their proper position ; and then a por-

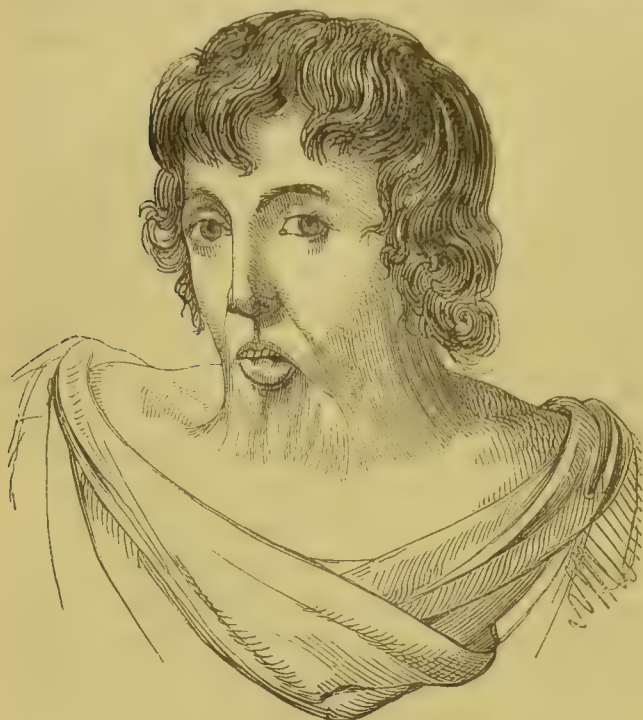


Fig. 209.

tion of integument and subcutaneous tissues, of suitable dimensions to occupy the gap, having been detached by incision from the vicinity, or from a part in juxta-position, is adjusted in its new place, and there retained by sutures and plasters ; a connecting slip being left undivided, whereby its vitality is maintained. It adheres, and effectually prevents recontraction ; the parts retain their normal position, and the deformity is—at least in some degree—removed. The wound, whence the atoning flap was taken, is brought together, and treated for either adhesion or granulation, according to its form and circumstances. Sometimes, as already stated, the new matter of the cicatrix is unduly prominent. In such a case, it may be brought to its proper level by pressure carefully applied ; for such structure is very amenable to absorption. Should pressure fail, the dense prominence may be excised, and the wound treated on ordinary principles. 11. *Amputate in certain cases.* When a limb is charred throughout its entire thickness, amputation is expedient at once ; so soon as the shock of injury has sufficiently passed away, to admit of the operation being safely borne. When a joint has been opened into, or a bone necrosed ; or when from any other cause suppuration is profuse, healing slow, and hectic urgent—the part must sometimes be sacrificed to save life. 12. *Throughout the whole cure, have great regard to the state of the internal organs, especially the lungs, serous membranes, and intestinal mucous membrane ; and chiefly during the inflammatory and suppurative stages.* Let it ever be remembered, that, in the case of extensive burns, the patient never can be reckoned safe until after the whole has

Fig. 209. Burn of the neck. Deformity caused by contraction of the cicatrix.

been fairly cicatrized. Nay, that sometimes the whole cicatrix may open up from some trivial cause, and the ulcerated surface resulting prove irritable or phagedænic. In some instances, the system may even have power enough, by a great and long protracted struggle, to effect complete cicatrization ; and may then sink, as if exhausted in the effort.

Such are the principles of ordinary surgery, which are suitable to guide us in the treatment of this form of injury. Some strenuously advise stimulating applications from the beginning ; and a theory has been made to suit the practice. Neither seem to merit unqualified approval. Alcoholic applications may sometimes prove serviceable, on a scalded but unbroken skin. There can be no doubt that, in scalds of the hand or foot, for example, the immediate application of spirits of wine is favourable to subsidence of pain. Also, in the severer injuries, any stimulant, at first increasing the pain, may afterwards be truly said to deaden it ; by accelerating and aggravating the inflammatory process, so as speedily to overcome the impaired vitality, and convert all into one slough. But such is not wise and prudent surgery. In all severe cases, let stimulants, both internally and externally, be retained for their proper time and place ; and these will be found in the second, sixth, and ninth indications of cure.

CHAPTER XXII.

EFFECTS OF COLD.

Frost Bite—The effect of intense cold applied to a part, so as greatly to diminish vital power, and not unfrequently to produce local death, more especially when heat or other stimulus is rashly used—we have already considered under the head of mortification.

The term *Chilblain* or *Pernio* is applied to a less evil ; the effect of cold, as affecting the texture more superficially. The parts most liable so to suffer, are those which not only are habitually exposed to great and sudden alternations of heat and cold, but are also naturally of comparatively weak circulation, and consequently easily debilitated ; as the fingers and hands ; the toes, feet, heels, and ankles ; the tips of the nose and ear. And these are most especially liable, when extreme circulation in the individual is naturally imperfect ; from dyspepsia, or other disease, or from original conformation. Like frost-bite, chilblain is usually not a direct but a secondary effect of cold ; caused by premature restoration of heat and circulation. Reaction is excessive, with diminished power of control. Yet a high degree of the inflammatory process does not ensue ; otherwise gangrene would inevitably result, and the case be termed one of frost-bite. The debilitated textures either become congested, or a chronic inflammatory process is established. An unpleasant sensation of heat is complained of, often attended or followed by an intolerable itching. The part swells, and becomes of a dark venous red hue. No further progress may be made, the part remaining in this congested state for a long period ; not advancing to higher morbid results, and but little disposed to recede. But, very frequently, vesicles form ; and these do not dry and desquamate in the ordinary manner ; but, having given way, disclose a painful ulcer with a smooth surface and thick white edges, emitting a slimy discharge, slow to heal, and prone to assume either the irritable or indolent characters ; often at first irritable, and secondarily indolent. Or, instead of vesication, the surface seems to crack ; and the fissures degenerate into ulcers of a similar kind. Usually, the ulceration is but superficial ; occasionally, however, where actual frost-bite has complicated the chilblain, it extends deeply, involving tendons, and even deeper parts.

Prevention is better than cure ; by avoiding exposure to extreme cold, more especially in the parts most liable to suffer. Using for the purposes of ordinary ablution lukewarm water ; neither cold nor hot ; always drying the skin thoroughly before exposing it to the air ; and when exposure has been incurred, taking care that reaction is gradual and safe, using, for this purpose, the means recommended in the case of threatened frost-bite. In children, tightly fitting shoes, stockings, and

gloves are very objectionable, being very frequent predisposing causes of such affections ; a frequent change of shoes and stockings should also be attended to so as to diminish as much as possible the cold, clammy, and moist condition of the feet.

When the congestive state has been induced, probably the best remedy is nitrate of silver, applied so as to blacken the integument ; carefully avoiding vesication. Some, however, prefer tincture of iodine, and others believe rather in the effects of stimulating spirituous liniments, such as the soap and opium with ammonia, or tincture of cantharides. Chloroform liniment, carron oil, or glycerine will usually allay the excessive itching better than anything else. For the ulcer and fissures, in their early and irritable period, nitrate of silver in substance is suitable ; followed by light poultice or water-dressing. When they have become weak or indolent—as they tend soon to do—various stimulant applications are required, such as the citrine or red precipitate ointment, the black wash, or even the application of a blister ; while attention must be paid to securing uniform support by careful bandaging. A bandage carelessly applied, so as to cause partial constriction, would certainly be productive of very serious injury to a part whose vital power remains so long and so much impaired. When sloughing has taken place, a soft poultice or water-dressing should be used alone until the slough comes away.

When the whole frame is exposed to intense cold, the general powers of life gradually cease. The patient grows feeble and languid, inclines greatly to sleep, sleeps, becomes comatose, and dies. On dissection, there is usually found considerable serous effusion within the cranium. To prevent the extreme sedative result, the mind must be made to work against the body. Sleep and lying down must be resisted, wakefulness and bodily exertion compelled. To restore, the same gradual appliances must be used as in regard to a part ; cold friction ; gradual increase of the temperature ; and very sparing administration of food, drink, and other stimulants, internally.

CHAPTER XXIII.

OF FRACTURE.

FRACTURE is a solution of continuity in bone, usually the result of external violence, directly or indirectly applied ; sometimes effected by muscular action alone, but apt to be followed by serious consequences, as suppuration, gangrene, erysipelas, phlebitis, or pyæmia.

Various terms are employed to designate the kind and circumstances of the injury. It is called *transverse*, *oblique*, or *longitudinal*, according to the direction in which the break has occurred. It is said to be *Simple*, when there is mere fracture of the bone, at one part ; and nothing more. *Compound*, when in addition to the injury of bone, there is an open wound of the superimposed soft parts, communicating with the fracture. *Single*, *Double*, *Multiple*, or *Comminuted*, when the breaking is at one point or many ; or occasioning numerous fragments. *Complicated*, when some serious injury of neighbouring parts influences prognosis or treatment ; as *e.g.*, when dislocation co-exists, or a traumatic aneurism forms in consequence of the injury inflicted by the broken bone on the neighbouring artery. It is said to be a case of *Fracture with wound*, when the co-existent wound of the soft parts is at a different place, and does not necessarily communicate with the injury of the bone. Fractures are sometimes *complete*, at other times the whole thickness of the bone has not given way ; they are then called *incomplete* or *partial*.

The parts of the skeleton most liable to fracture, are the long bones, more especially of the extremities ; and these may suffer by violence applied either directly or indirectly. The flat and spongy bones, with the exception of those of the cranium, are less liable ; and seldom give way except under violence which is both direct and severe.

A bone does not always break at the point struck. A blow on the symphysis menti, in most cases, occasions fracture of the jaw at the bicuspid teeth, midway between its symphysis and the angle ; a concussing force applied to the lower extremity, through the foot, ordinarily expends itself in producing fracture of the tibia near the ankle, and of the fibula at its upper part.

The broken fragments usually become more or less displaced ; this is not, however, always the case, as we see in the skull, and in the fracture of one of twin bones. In the long bones it is least marked in those cases of transverse fracture, where the force occasioning the lesion has acted directly. The direction of the force wherewith the injury was inflicted may push one or both portions at the seat of fracture past each other ; and the weight of the limb or body may increase displacement by *angulation* or *rotation*, when the part is raised, or when an attempt is made to use it. Another important agent in effecting further displace-

ment when the ends of the broken bone have passed each other, or ride one over the other, is the action of those muscles which are implicated in the injury, and which tend to approximate the extremities of the broken bone. Sometimes, instead of riding, there is separation of the fragments from each other; as in transverse fracture of the patella. Most frequently, the fragments cross and overlap each other, with consequent shortening of the limb. Sometimes one fragment alone is displaced; as in fracture of the clavicle; the sternal portion remaining nearly in its proper place, while the lower passes downwards and forwards. In other cases, both suffer displacement; as in fracture of the humerus below its bicipital groove; the upper fragment passing in towards the chest; the lower being elevated, and displaced outwards, by the deltoid.

One fragment usually is on a higher level than the other, seeming as if it had risen above its fellow; and hence we frequently speak of "the rising end of the bone." But this phrase, if not rightly understood, may lead to great practical error. The sternal end of the fractured clavicle seems to rise, but in truth is in its place; while the lower fragment has fallen away. And in attempting readjustment in this fracture, we are not to repress the apparently "rising end;" but, leaving it alone, we bring up to its level the one which is truly displaced. On the other hand, the "rising end" is both real and apparent; as in fracture of the tibia, below its tubercle; and in fracture of the femur, below the trochanter minor. In each of these cases, the upper fragment is truly tilted forwards; and means for its reduction are undertaken with propriety.

By the displacement, neighbouring parts are liable to be compressed, torn, or otherwise injured; and hence the most serious complications may ensue; unless such displacement be detected, understood, and speedily rectified. For example, the displaced fragments of a broken rib may puncture and irritate the pleura and lungs, exciting violent inflammatory access there. And displaced portions of a broken cranium may cause a like injury to the brain and its membranes, followed by results still more disastrous.



Fig. 210.

Proneness to fracture varies with age. The bones of the old man are brittle, and give way under a degree of violence which would have little disturbed them in younger years. The bones of the child, on the contrary, are as likely to bend as to break; although, indeed, it is true that fracture takes place even in utero.

Bending of the long bones, with *partial* (*incomplete*) fracture, from force applied to their extremity, is by no means uncommon in the child and adolescent. The bones of the fore-arm, for example, are not unfrequently found more or less bent, from a fall saved on the hand. Con-

Fig. 210. Fractured spine, bisected; shewing an inevitable, formidable, and often fatal complication—injury to the spinal cord.

tinuity is plainly uninterrupted, and bending is apparent ; there is much pain, deformity, and loss of power, but no crepitus ; the bending can be undone, by force suitably applied ; and then, for the first time, crepitus will be perceived. A few of the osseous fibres had given way, on the convexity of the curve ; and these, not being brought into apposition, could give no crepitus. In straightening the bone, the fracture may be rendered complete ; or, at all events, the already ruptured fibres will be brought into contact ; and in either case, crepitus is at once elicited. In other cases, bending is unaccompanied with any solution of continuity. For example, a child may receive a smart blow on the head ; depression of the cranium may be so occasioned, without any fracture ; and the depressed portion, by the innate and gradual resilience of the osseous tissue at that age, ultimately resumes its normal relative position.



Fig. 211.

Constitutional vice often predisposes to fracture. The cancerous diathesis does so, as we have already seen ; and, still more, that abnormal condition of the skeleton denoted by the term "*fragilitas ossium*." It is a common saying that the bones are more brittle in frost than at other times ; but, probably, the greater frequency of fractures in the winter months can be more rationally accounted for, by the increased liability to fall, and by the hardness of the ground on which the falling body is received. The functions of

certain bones predispose to their fracture ; the clavicle, supporting the shoulder, is rendered liable to fracture by blows or falls on that part ; and the radius is similarly circumstanced, when compared with its companion the ulna, in consequence of its special connection with the hand. Others, again, are rendered liable by the mere exposure of their position. The unprotected cranium, for example, is more liable to fracture than the comparatively well-cushioned scapula ; the clavicle is more liable than the ribs ; and any of these is more liable than the spine.

While such circumstances may be said to be the predisposing causes of fracture, the exciting causes are two ; external force and muscular action. Force may be applied directly ; as by a blow, or by a heavy weight passing over the part. Or it may be indirect ; as when the clavicle breaks from violence received on the shoulder ; or the fibula, near its head, from a shock sustained on the foot. Again, fracture of a bone may be effected by muscular agency alone ; as when the patella, or olecranon, is snapt across, during an intense and sudden muscular effort ; or, as is not uncommon, when the humerus gives way during the effort to throw a stone, or under attempted feats of strength.

The *Symptoms* of fracture are usually very plain. There is obvious *deformity* of the part at the seat of fracture, and *distortion* of the limb ; while its muscular power is all but lost. A fractured arm, for example, is crooked, swollen, shortened, and twisted—in short, "out of drawing ;" and the patient is unable to move it, without the assistance of the corresponding member. Sometimes, as in the case of the patella, the part is

Fig. 211. Partial fracture, with bending of the femur.

elongated ; much more frequently it is shortened ; the lower extremity, in fracture at the femur, may be abbreviated to the extent of two inches or more. Voluntary motion is much abridged ; in many cases the patient, of himself, can move the injured limb little if at all. Involuntary motion, on the other hand, is much increased ; that is to say, the surgeon can, though not without inflicting much pain, move the limb in directions and to an extent of which it was previously incapable. And, at the site of fracture, the slightest examination usually makes it abundantly plain that the part is remarkably and preternaturally mobile. Pain is great and constant ; and ever and anon liable to sudden exacerbation, from spasmodic twitchings of the muscles implicated in the injury, whereby the bones are displaced anew, and the soft parts irritated and torn. If either fragment come in contact with nervous trunks, compressing, puncturing, or in any way irritating these, the pain is likely to prove extreme.

Swelling invariably occurs in cases of fracture, and is of three kinds. 1. The displacement and overlapping of the fractured ends produce a greater or less enlargement of the part, immediately after infliction of the injury. And if muscles be relaxed by the displacement, the bulging into which they are consequently thrown will contribute to the immediate swelling. 2. The first swelling is increased by extravasation of blood ; which inevitably follows solution of continuity in the bone, and coexistent laceration of the soft parts. If any considerable vessel have been injured, this kind of swelling may prove very great ; partly by blood accumulating around the fracture, partly by its being infiltrated into the muscles and other surrounding tissues. 3. The second swelling, in its turn, is followed and modified by that which attends on the inflammatory process ; beginning to form after the lapse of some hours. The tissues then become infiltrated ; partly by serum, partly by plastic product.

But the peculiar and diagnostic sign of fracture, is what is termed *Crepitus* ; a sensation of rubbing, grating, and crackling, which is imparted to the hand of the surgeon, when the fragments are moved one upon the other, their broken surfaces being in contact. When there is no great displacement, the fractured ends remaining partly in apposition, this crepitus may be felt on the slightest movement of the limb ; and often both the patient and his attendant are made very plainly aware of its existence, by the involuntary movements which spasm of the muscles from time to time occasions. But when the fracture is transverse, the displacement great, and the fragments completely overlapping, crepitus is not so easily felt. Reduction of the separated fragments must be effected in the first instance, in order that the broken surfaces may be brought in contact with each other ; and then, by movement, the desired sign will be plainly enough emitted. In fracture of the neck of the femur, for example, rotation of the limb will be quite unattended with crepitus, so long as the lower fragment is drawn upwards and inwards, and lies close to the brim of the acetabulum, free from the head of the bone ; but so soon as, by extension, normal length of the limb has been restored, crepitus will be produced by but very slight movement.

Certain fractures, termed *Impacted*, rarely afford crepitus. One

fragment is driven into and lodged in the cancellous texture of the other, by the same violence which caused the fracture; and so the bone, although really broken, seems rigidly firm. There is usually besides but little deformity, and usually no distinct crepitus under ordinary manipulation. Examples of this form of injury are constantly met with, in fracture of the distal extremity of the radius, and at the trochanteric portion of the femur.



Fig. 212.

Diagnosis.—The manipulations necessary to ascertain the nature of the accident, and which are especially directed towards detection of crepitus, are to be conducted with all gentleness; so as not to produce unnecessary pain, or endanger further injury to the soft parts, with aggravation of subsequent inflammatory accession; and yet with deter-

mination, sufficient for fully satisfying the examiner as to diagnosis. It is much better that one thorough examination should be made at once, painful though it be, than that more gentle movements and inquiries should be made with frequent repetition; delaying the means of cure. Also let it be borne in mind that, at whatever cost of suffering to the patient, it is our paramount duty to make such a thorough examination; for two reasons. In the first place, in order that the required repose and treatment of the part may be immediately instituted; in the second place, and mainly, that error of diagnosis may be avoided. For, suppose that in the hip insufficient examination has led to the latter event; that a fracture is believed to exist, while in truth the injury is dislocation. The ordinary treatment for fracture is applied, and continued for the usual period. On finally undoing the retentive apparatus, the true nature of the case may be for the first time disclosed; too late to remedy the evil. The patient remains a cripple for life; and an untoward event has happened to the surgeon's welfare and reputation.

Anæsthesia is of great advantage here; especially in the young, and in those who from any cause are intolerant of manipulation. They are saved all suffering; and the surgeon, undistracted, and in quiet leisure, deliberately satisfies himself as to the condition of every part—all the more readily and accurately because the muscles are rendered pliant and unresisting.

The required examination should always be conducted in an orderly manner, such as the following:—The clothes should first be carefully removed; stripping the uninjured limb first, so that the sleeve of the coat, or leg of the trowsers, may be taken off with as little pain to the patient, or injury to the limb, as possible. In many cases, it is better to rip up the seams rather than lift the limb or interfere with the parts, especially when the injury is probably severe; as by too free motion many a simple fracture has been converted into a compound injury. Next, before proceeding to manipulate the injured part, its position, as spontaneously assumed, and any change in external form, length, or

Fig. 212. Impacted fracture, through the trochanters. The upper fragment is wedged into the lower.

direction, should be carefully noticed ; comparing it for this purpose with its fellow ; and bearing in mind, at the same time, that in an accidental case, where the surgeon has no previous acquaintance with the patient, such deformities as are present may be due to old standing disease, or some previous injury. Furthermore, in estimating the changes which appear to be present in the injured limb, regard must be had to the position of parts. Thus, when the lower extremity seems shortened, the patient lying fairly on his back, the difference in the length of the limbs can be determined only after being assured of the horizontal position of the two anterior superior iliac spines ; measurement from these as fixed points being resorted to, if need be, accurately to settle the matter. The normal relation of certain prominences should also be borne in mind ; thus the inner side of the great toe should correspond, in a sound limb lying horizontal, to the inner side of the patella ; while, if it correspond to the outer side, fracture of both bones of the leg may almost certainly be determined as the cause of the change. The site where pain is most intensely felt should next be accurately determined, both by inquiry at the patient, and—especially if he is only partially sensible—by careful manipulation of the part. This of itself will frequently suffice to decide, in a case of injury of the wrist or ankle, between sprain of the ligamentous apparatus of the respective joints, and fracture—of the radius in the one example, of the fibula in the other. Next, the presence of displacement of the bone at the site of injury should be carefully noted ; pressing gently along the prominent spine of the tibia or scapula, for example, and finding the projecting rising end of the bone, then a hiatus, and then again the portion of bone which naturally should have been continuous—displaced and carried away laterally, longitudinally, or by rotation, as the case may be. Not till the surgeon has satisfied himself as to all these particulars, should he proceed to examine for the detection of crepitus, and increased mobility at the seat of fracture ; and in many cases, he will already be so certain of his diagnosis (independently of these physical signs) as to be able at once to inform the patient and his friends of the nature of the injury, and obtain the requisite apparatus for treating the fracture. In this way the patient is saved unnecessary pain, the pain of manipulation and of the so much dreaded “setting” being merged in one. The procedure then is as follows :—The patient having been arranged in a suitable posture, the distal extremity of the injured bone is taken hold of by the surgeon’s right hand, while his left is placed over the seat of injury. With the right hand—or when the limb is large, by the aid of an assistant—the limb is gently extended, till normal length is nearly or altogether restored ; then, while extension is maintained, gentle rotation is made ; and the fingers of the left hand or both hands are used to coaptate, so as to bring the broken fragments—if such there be—in contact, that they may rub on each other, and thus emit the characteristic and decisive crepitus. At the same time, by the increased amount of mobility at the seat of injury, it is made apparent that solution of continuity exists in the shaft of the bone ; the lower fragment being now found to roll in obedience to the rotating movements of the manipulator, while the upper, just as plainly, is unaffected by them.

It is obviously of much importance that such examination should be made at as early a period as possible ; before reaction has taken place, and spastic rigidity of the implicated muscles has set in, which will certainly oppose to some extent the required extension and coaptation (if anæsthesia be not employed) ; and before concealment of the relative position of parts has taken place, either by extravasation of blood, or by accumulation of the products of the inflammatory process.

The *Prognosis* varies, 1, according to the age of the patient. In the young the process of reparation is usually both more rapid and efficient than in advanced years ; also the general health is less liable to suffer from serious complication, and from the confinement which treatment may require. 2. According to the situation of the injury. Fracture of a long bone, near its middle, is less important than a similar injury which implicates the articulating end. Fracture of a slight and superficial bone, as the clavicle, is less likely to prove troublesome than similar injury of one which is large and thickly covered, as the femur. Fracture of the neck of the femur, within the capsular ligament, is but little capable of satisfactory union ; while a more severe amount of injury, immediately exterior, through the trochanters, unites readily. Fracture of the scapula is seldom troublesome, either at the time or subsequently ; fracture of the bones in two parts of a limb constitutes a very serious form of injury, as recovery without deformity is almost impossible ; fractures of the cranium, pelvis, and spine, are invariably fraught with danger, not from the injury done to the bone, but on account of the important parts contained within, which are likewise concerned in the injury. 3. According to the nature of the fracture and the degree of displacement. The Compound is obviously more hazardous than the Simple ; the Comminuted, and the Fracture with Wound, or otherwise complicated, are more likely to prove troublesome than the fracture which is in all respects Simple. A fracture which is transverse and unaccompanied by displacement, is the simplest of all. Where the fracture is very oblique, and there is any great degree of displacement, the fragments can scarcely be so thoroughly kept reduced by treatment, however ably conducted, as to restore the parts to their original symmetry. 4. According to the state of system. The patient in ordinary health is more likely to advance favourably, than one who is either debilitated by privation or disease, or plethoric and prone to undue excitement. Also the patient affected by any constitutional vice, which favours the occurrence of fracture, is obviously situated unfavourably as to cure. It will be often found stated, on hardly sufficient grounds, that the pregnant female has a slower union of fracture than would otherwise happen ; it having been supposed, theoretically, that the nutritive powers of the system are almost wholly devoted to the exalted uterine function.

The mode of union, or reparative process, is a subject of much importance ; on the right understanding of which the indications of treatment depend. It is found to differ, 1, according as it occurs in the lower animals, under experiment ; 2, according as it occurs in man, with the bones not fairly adjusted and retained ; 3, according as it occurs in man, with the fragments accurately arranged and kept immobile. In the first of these conditions—following the observations of Dupuytren—

it may be conveniently divided into the following stages:—1. Blood is extravasated at the site of fracture; and, accumulating, distends the surrounding parts into a kind of pouch in which the fractured ends are laid; and the cavity of this pouch is occupied by the extravasated blood, partly fluid, partly coagulated. The surrounding parts are condensed; and, obeying the stimulus of the injury and displacement, become more energetic in their circulation, in order to supply the unusual demand which is now beginning to be made on them. 2. The extravasated blood is absorbed; and the ends of the fractured bone also undergo alterations; being deprived of their earthy matter to a great extent, by conversion into granulation tissue, and so prepared for their new circumstances. Plastic matter is formed from the walls of the pouch, from the ends of the bones, and from the periosteum which invests them; and this assumes the position which the extravasated blood occupied; the latter undergoing gradual absorption. This granulation tissue exists abundantly between the fractured ends of the bone, and in their interior. At the same time, a similar, though less copious change, is taking place in the soft tissues exterior to the pouch, whereby they are still further condensed. 3. After eight or ten days, the new plastic material passes into the transition state of fibrous tissue, fibro-cartilage, or even true cartilage. 4. The organized and transitional mass contracts, by interstitial absorption, increases in density, and gradually passes, by ossification of its connective tissue, into the condition of bone. 5. Ossification advances, from the periphery, commencing from the parent bone. Nodules of new osseous matter form on it, where in contact with the ruptured periosteum, by ossification of the granulation tissue; and these ossified granulations seem to constitute the nucleus or base of the new bony structure which speedily surrounds the seat of fracture. For from these nuclei it is that the ossification advances, and a case of bone forms on the exterior of the new product; advancing from each fragment, and meeting near the centre of the space. Where the original periosteum is deficient, there is no corresponding hiatus in the new bone, as in the case of necrosis; for, as the ordinary soft tissues are not in a state of suppuration, the process of ossification is permitted to go on undisturbed. As ossification advances, the mass contracts more and more; ultimately forming a firm osseous ferrule, by which the fractured ends are tightly clasped, and the continuity of the bone apparently restored. This ossified mass is termed the *Provisional Callus*. And the period of its formation averages from four to six weeks. At the end of this time, the bone feels firm; for the fractured ends are tightly held together by the ferrule. Ossification between the ends of the fractured bone, in the case of a large bone such as the femur, is not, however, yet accomplished. 6. The *Definitive callus* is that which is formed between the ends of the bone, and which constitutes the final medium of their incorporation. Its organization and ossification are effected by a more slow and gradual process than that of the provisional callus. By the *definitive* and permanent callus the ends are firmly fused together, and the fracture truly united; the medullary canal being obliterated for the time being. In proportion as construction of the definitive callus advances, the provisional gradually diminishes by absorption; the latter being merely subservient to the former. The provisional callus,

indeed, may be termed Nature's splint; whereby the parts are kept in close and undisturbed contact, until their real consolidation shall have been completed. When this has been achieved by the definitive callus, all necessity for the presence of provisional callus has gone by; and consequently it is soon thereafter removed by absorption. At the same time, absorption is also busy with the temporary change of structure in the soft parts; restoring these nearly, or altogether, to their normal state. The repair in the main structure having been completed, the exterior scaffolding by whose help that repair had been effected is taken away. And thus not only is the bone firmly and truly reunited; its symmetry and usefulness are also restored. This gradual change is seldom com-



Fig. 213.



Fig. 214.

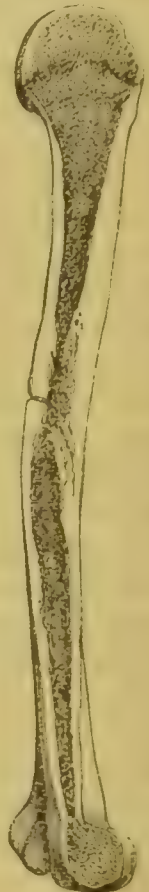


Fig. 215.

pleted in less than many weeks; and, in some cases, even a very long period is required. 7. The definitive callus is at first preternaturally

Fig. 213. Fractured radius, bisected; shewing a large amount of new material beneath the periosteum.

Fig. 214. Section of humerus, shewing double fracture united. At *a*, though there is still some preternatural density, continuity of texture is almost completely restored. At *b*, where coaptation has not been so accurate, absorption is busy in accomplishing the same end; the projecting dense laminae being gradually converted into cancellous texture.

Fig. 215. Humerus bisected; shewing reparation after partial fracture. Unusual density at the injured part; but absorption busy in restoring the cancellous portion, by a reversion of the osseous into granulation tissue, and thereby fatty change into medullary tissue.

dense and compact ; but is gradually modified by absorption ; and ultimately is so changed as to render continuity of the normal texture of the bone complete. On making a section of recently united bone, a dense compact mass of new osseous matter is found intersecting the cancellous texture at the site of fracture ; but, after a few years, section discloses that part of the bone's interior perhaps a little more dense than elsewhere, yet open, and quite of the cancellated character. And thus it would seem that not even the definitive callus can be said to be truly permanent. On the contrary, all callus is temporary ; it has a certain duty to perform, like the uniting plastic tissue of soft parts ; and, that having been achieved, it is gradually taken away.

In the human subject, also, the process of union is effected in this way, in the case of certain bones, which cannot be accurately fixed and made motionless in the treatment—as, for example, the ribs, the clavicle, and perhaps the radius. And in all cases where, from some cause or other, there is mal-adjustment—whether with motion or not—the fractured ends crossing more or less, or completely overlapping—the permanent union is necessarily and mainly effected by provisional callus ; new bone in greater or less quantity filling up the angles and spaces between the ends, and “facing” these up with a dense laminated formation.

When fracture in the human subject is well treated, with accurate adjustment and prevention of all motion, the process of union is very analogous to what occurs in other tissues by “adhesion.” The new granulation tissue is formed mainly between and from the ends of the bones ; and, passing from fibrous tissue into bone, restores continuity without much redundancy on the outside. There, however, there is no inconsiderable amount of hard swelling in connection with the healing process which is going on simultaneously in the periosteum, muscles, and other soft tissues which have been implicated in the injury.

In bending with partial fracture of the long bones, repair takes place as in complete fracture.

Practically, it is important to remember, that the new bone remains to some extent soft and pliable, during the first few weeks of its existence ; not so yielding as to admit of motion between the fractured ends, under ordinary circumstances ; yet pliable enough to admit of mal-adjustment being gradually rectified (if unhappily that have taken place) by pressure duly applied ; also pliable enough to permit serious and untoward bending, if the functions of the part be too soon and too freely resumed. A broken leg must be warily used, for some considerable time after apparent consolidation ; and a broken bone, anywhere, may have its contour remedied, if need be, by suitable pressure—applied even after the process of reparation seems to have been well-nigh complete.

When there is a hiatus between the fragments—more especially in the case of flat bones—through imperfect coaptation, the medium of union not unfrequently fails to pass into the osseous state, and remains fibrous. And sometimes this is desirable rather than otherwise ; as in the case of the patella. If the ligament be short, it is very efficient ; and perhaps less liable than new bone to yield under reapplication of violence. It may remain permanently of the fibrous character, only increasing in

density ; or it may very slowly become ossified, as in the case of deficiency in the cranium after exfoliation or the use of the trephine.

Treatment of Fracture.

This may be said to consist of three parts :—*Reducing* the fragments to their proper position ; *Retaining* them so ; and *Preventing* re-displacement, or other evil consequences. *Reduction* is effected without force, and gradually. The measures resorted to with the object of reducing the fracture are three in number—*Extension, Counter-extension, and Coaptation*—not all equally necessary in every case ; *e.g.*, the extension and counter-extension employed with great advantage in the treatment of most fractures of the long bones, is useless in such fractures as those of the patella, olecranon, pelvis, ribs, or cranium. Where, however, extension and counter-extension are required, they may be effected by the surgeon himself in the bones of the upper extremity, and by means of one or more assistants in the lower extremity. With one hand, or by one assistant, the limb is grasped on the distal aspect of the fracture, and extension made gently yet determinedly ; the limb being at the same time placed in such a position as to ensure relaxation of those muscles most likely to oppose this movement. For example, in fracture at the ankle the leg is to be placed in a flexed posture, to relax the gastrocnemii ; otherwise, much difficulty may be encountered, and the use of injurious force rendered necessary. With the other hand, or by another aide counter-extension is effected ; and coaptating movements are made by the surgeon himself, or by the same hand which keeps up the counter-extension, if but one is engaged in the treatment of the case. In this way the fractured ends, which by extension and counter-extension have been brought to the same level, are placed in immediate and accurate contact. This constitutes reduction. The limb is then laid down gently on the bed or couch ; and the hands retain this normal arrangement of the part, until the suitable retentive apparatus shall have been applied. At one time, it was proposed to delay reduction until the inflammatory stage had passed ; leaving the part meanwhile almost unconfined, and using fomentation and poultice. But as it is very obvious that the jerking of the limb, and other movements, voluntary and involuntary, to which it must be subject, will maintain and aggravate the dreaded affection so long as the displaced ends of the bone continue to excite the muscles to spasmodic contraction, it must be clear that the sure way to avoid this is to reduce at once, ere swelling or rigidity of the implicated muscles have yet had an opportunity of opposing extension. Thus no unnecessary and additional injury is done to the soft parts ; either by continued jerking movements of the spiculated ends of the bones, in consequence of coaptation not having been effected ; or by employment of force in extension, when adjustment is at length desired. Under the use of chloroform, reduction will not only be rendered painless, but also more easily accomplished.

Retention is effected by the fulfilment of two obvious indications. First, by keeping the limb in such a posture as shall relax those muscles which we know to be the most busy and powerful agents of displacement.

ment. Secondly, by applying mechanical means externally to the fractured part; adapted to prevent motion. These mechanical appliances are termed *Splints*. They are variously constructed, but all with one object in view—to rest lightly and easily on the part, and yet be successful opponents of motion in the fragments. They may be made of iron; as the double inclined plane, so useful in most fractures of the leg. Or



Fig. 216.

of wood; as the ordinary splint for fractured femur, and fractured fibula. Or of pasteboard; as in fracture of the bones of the forearm. Or of leather, or gutta percha; like the splints found so useful in chronic affections of the joints. Or of straw, as employed in army practice. Or of soft materials saturated in gum or starch, which become tightly adherent as well as accurately fashioned to the part. The wood, iron, pasteboard, and gutta percha splints are those most commonly in use, and most generally applicable. They are retained by bandaging, uniformly and evenly applied; not so slack as to admit of any motion between the fractured ends; and not so tight as to endanger undue pressure or constriction, either on any part or on the whole limb. The first application of the bandage should be rather slack than otherwise; allowance being made for swelling and engorgement, which are certain to occur, to a greater or less extent, in the course of a few hours. The splints should invariably be of sufficient length to command the neigh-

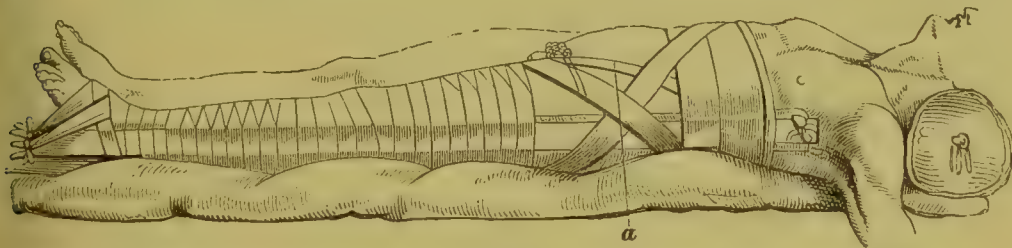


Fig. 217.

bouring joint or joints; otherwise, by rotation, voluntary or involuntary, redisplacement will certainly be effected. In fracture of the radius, for example, unless the wrist be completely commanded, pronation of the upper fragment with supination of the lower will occur; inevitably causing displacement, ill-adapted callus, and a weak as well as unseemly limb. A short splint, extending a little above and below the fracture

Fig. 216. Splint, ready for application. The long splint in use for fractures high in the thigh.

Fig. 217. The splint applied. This may both more readily and commodiously be effected by enveloping the splint in a cotton sheet, folded in its width to correspond to the distance between the anterior superior iliac spine, and the external malleolus. The splint wrapped in this is thus padded, while so much of the sheet is allowed to remain loose as will suffice to encircle both splint and limb, so that when carried round both, its free edge may finally be pinned to the sheet along the outer side of the splint.

only, has been well characterized by Mr. Pott, as “not only an absurdity, but a mischievous absurdity.” In order to protect the integument from being chafed by the splints, they are lined suitably ; with fine tow, or cotton wadding, or soft flannel, or linen ; or—especially in hospital practice—the larger splints may be furnished with small mattresses, stuffed with chaff, bran, or hair ; the protecting cushion being hollowed out where pressure is likely to be greatest, and where chafing consequently is probable.

Splints and bandaging having been duly applied, the limb is placed in a comfortable and suitable posture, and so retained ; relaxation of the displacing muscles, if practicable, never being forgotten. A pillow, if need be, may be adjusted beneath the part. But the general mattress or couch, on which the patient is laid, should be rather firm than otherwise—more especially in fractures of the spine and lower extremities—in order that a tolerably uniform level may be maintained. When the double-inclined plane is used for the lower limb, this indication may be further fulfilled by placing a flat board below the lower part of the splint. After due adjustment, the parts cannot be too little disturbed. Should the bandage become tight, from inordinate swelling of the limb, or should pain be complained of ; should an involuntary movement have obviously caused redisplacement ; or should subsidence of swelling, or restlessness of the patient, or both, have slackened the bandage—permitting too great a latitude of motion between the fractured ends—the retentive apparatus undoubtedly ought to be reapplied. But not unless. The “*nimia diligentia*” of surgery is bad in wounds ; it is worse in fractures. Daily dressing, movement, and manipulation, may, in the eyes of the ignorant, express great care and anxiety, and even skill, on the part of the practitioner ; but, in the mind of the well-informed, the same evidence convicts him of glaring ignorance of the first principles of treatment. It is most essential for due advancement of the process of reparation, that the uniting part should be placed and retained in a state of absolute repose. Watchfulness and meddling are widely distinct. We cannot satisfy ourselves to often—from examination both by sight and touch, and also by regard to the general state of the system—that all is advancing favourably at the site of fracture ; but, at the same time, we cannot too seldom interfere with the position of the limb—when this continues accurate and easy.

Sometimes it is advisable to supersede the common splints by those of gum or starch. Pledgets, and even narrow lateral splints of soft pasteboard or thin wood, with several layers of bandaging soaked in starch, gum, or glue, are applied so as to envelope the whole limb accurately ; in the same way, and to the same extent, as ordinary retentive apparatus. But it is necessary to continue extension, and (if not applied internally) temporarily to put on a wooden splint outside, until the apparatus has become dry and hard—when it forms a tight, accurately fitting unyielding case, in which the broken limb lies securely imbedded. During the first period of the treatment of severe fractures, the application of this in mass is unsuitable ; for considerable swelling must occur, requiring proportionate slackening of the retentive apparatus, which ought consequently to be light and easily changed. Further on in the case, when swelling has reached its acmé, and has begun to subside, it is still inappropriate ;

applied to-day, the limb may have shrunk by to-morrow, so that the apparatus has ceased to be retentive. But when the time for inflammatory swelling has gone by, and when further decrease of the more or less swollen limb is improbable—then the permanent, fixed, and unyielding nature of the application ceases to be detrimental, and becomes most salutary. If used sooner—and by many it is now used in most cases of simple fracture of the limbs from the very first—it ought not to be in mass, but after bisection; so that the apparatus then comes to resemble two neatly and closely fitting splints of the ordinary kind. And in order still further to obviate the chance of strangulation, the splinted limb may be incased in a sleeve or stocking of elastic material, instead of the ordinary bandaging.

An equally immovable and tight fitting “case” may be made for the fractured limb, by imbedding the whole in plaster of Paris; or by filling the interstices of a flannel bandage, as it is applied, with the gypsum powder, which is afterwards moistened with water, and the limb kept steady till the plaster has “set.” But such a dressing though very easily effected, and very certain in action as regards due retention of the fragments, is not always safe as regards the risk of inflammatory accident; and if not cold, is as least comfortless. But further still, when required to be removed, it becomes not only an arduous task to the surgeon, but sometimes a painful one to the patient.

In the case of an obstinately “rising end” of a bone, it may come to be a question whether or not pressure should be employed, as by compress and bandaging, to force it into normal position. In general this question is to be answered in the negative. The pressure, unless very severe, is not likely to succeed; even when severe it may fail; and it is apt to occasion ulceration or sloughing of the integuments, or abscess more deeply seated—events all most unfavourable to the process of cure. It is better, by attention to position, to relax the muscles which are causing displacement; and to bring the other fragment higher in its level, until a smooth and continuous adjustment shall have been thus attained. Most certainly, when the rising of the end is only apparent, and not real, as in the case of the clavicle, nothing can be more unwarrantable than the application of pressure to the part which is in truth not displaced. In such circumstances, however, Malgaigne has recommended the employment of sharp needle points, which, attached to the splint behind by a metal arc, can be screwed down through the superimposed soft parts, so as to force back the rising end of the bone and retain it in its normal position. According to those who have resorted to this method, the needles cause no pain or inflammatory irritation, and never occasion suppuration.

Occasionally it is found very difficult, notwithstanding every care, to keep the bones in apposition; muscular action being constantly at fault. Under such circumstances, it has been proposed, and not unreasonably, to have recourse to tenotomy. For example, in fractures of the leg, which may not otherwise be kept duly arranged, subcutaneous division of the tendo Achillis may be practised; with immediate and decided advantage as regards the fracture, and with impunity as regards any ulterior result.

In most examples of fracture, extension is with propriety discontinued so soon as the retentive apparatus has been duly applied. But, in some cases, continuance of a certain amount of extension is necessary; otherwise, by involuntary muscular action the fragments will again be made to overlap, and the limb will become shortened and deformed. In fracture of the thigh, for example, maintenance of permanent extension is on this account deemed essential; and is usually effected by means of the long splint, acted on by a band attached to its upper extremity and passed over the perineum (Fig. 217, *a*); by the tightening of which band, the splint, and the limb with which it has become as it were incorporated, are pushed steadily downwards. Or the same indication might be fulfilled, by suspension of a weight to the distal extremity of the limb, the patient's bed being somewhat elevated towards the foot.

Recently, Mr. Syme, Malgaigne, and others, have expressed their dissent from this plan of treatment—more particularly in the case of the thigh—believing that when the fracture has been reduced and measures employed to retain the parts *in situ*, the tendency in the muscles injuriously to retract the fractured ends of the bone will cease spontaneously, and that in those cases where they continue to maintain displacement, this is due to the direction of the line of fracture which does not admit of perfect readjustment. In such circumstances, accordingly, they make no attempt to keep up extension; considering it vain to attempt successfully to carry on a contest with the muscles in the hope of wearing them out.

In some cases, no splints are required; coaptation being both effected and maintained by mere relaxation of muscles, and attention to position; as in fractures of the clavicle and patella.

In the treatment of all cases of fracture of the lower extremity, the existence of a suitable bed is a *sine qua non* to the attainment of a successful result. It should not be so broad as to prevent the surgeon from getting easily at his patient from either side; there should be no foot-board; the mattress should be firm, but elastic, and laid upon a solid unyielding straw palliass; there should be no feather bed, under any circumstances; and a slip sheet should be arranged beneath the hips, so that those parts may be kept, by frequent shifting of it from side to side both cool and clean. A very great comfort to most patients during the long period of confinement to the recumbent posture which a fracture of the thigh, for example, implies, will be a foot-board attached to the lower part of the bed on the side corresponding to the sound leg, by which he may be able to shift himself upwards, and prevent the downward sliding which without it is inevitable. By some, a rope attached to the roof of the bed or room, and corresponding to the position of the patients' arms is found serviceable, by enabling them to assist in raising themselves when being shifted, or when the bed-clothes are changed. In the treatment of fractures of the leg, "*Salter's swinging cradle*" will be found a very great comfort to the patient, permitting him to shift his position in bed whenever he chooses, without disturbing the fractured bones: the limb and its retentive apparatus moving as a whole, along with the swinging sling, which follows, and adapts itself to every movement of the trunk.

Prevention of redisplacement, or other evil consequences, is best achieved by duly carrying out the just principles of retention ; keeping the fragments rightly adjusted, restraining motion, and taking care that bandaging is never too tight at any part of the limb. The limb, it has been stated, is to be kept in a posture favourable to muscular relaxation, and consequently conducive to the feeling of comfort. Besides, it should be placed so as to favour venous return, while an opposite influence is exercised towards arterial influx ; the forearm, for example, is slung, with the hand raised ; and the lower limb is kept on the same level as the rest of the body, with the foot elevated. Undue motion and excess of the inflammatory process are the great opponents of union ; and either is quite sufficient to prevent it wholly. Suppuration having occurred, the "pouch" becomes an abscess, incision is necessary, the case becomes compound, and cure may be indefinitely delayed. During the first few days, it is consequently our object to watch the indications of inflammatory change in the part ; and to take every precautionary means in our power to prevent its excessive advancement. At the first, we have contributed much towards the object in view, by gently yet at once effecting reduction, and maintaining it undisturbed ; the main cause of inflammatory excess has thus been taken away—and that timeously. Diet should be low, yet not strictly antiphlogistic ; unless suspicious symptoms arise. The bowels are regulated ; but purgatives are seldom expedient, the manifold motion of the whole body which they necessarily occasion tending to injury. In hospitals, the fracture bed is useful, by permitting evacuation of the bowels without movement of the limb. If sensations of heat, pain, and throbbing occur in the part, with restlessness, flushing of the face, and acceleration of pulse, blood may be taken from the arm, in the robust and healthy ; antimony or aconite is administered, and diet is brought down to the strictly antiphlogistic scale. And under such circumstances antiphlogistics will be especially active and early, in those cases in which fracture is in the near vicinity of important parts ; as in the case of the ribs and calvarium. If there be much involuntary spasm of the implicated muscles, jarring the fragments, opiates are useful. If the signs of inflammatory excess are distinct and advancing, notwithstanding the ordinary precautions, the retentive apparatus must be undone, and discontinued at the part ; to admit of cold evaporating lotions, or leeches and fomentation. But this casualty is of rare occurrence in the simple fracture, whose ordinary treatment is duly conducted. Should abscess form, it must be treated in the ordinary way ; by an early and dependent opening ; after which the further progress of the case is that of a compound fracture.

After the first eight or ten days, the risk of inflammatory excess may, under ordinary circumstances, be said to be past. Diet, accordingly, is gradually improved ; for it is essential to maintain considerable vigour in the frame, in order to obtain a due and early completion of the process of union. And this ulterior necessity should never be lost sight of in the earlier part of the case ; more especially when antiphlogistics have unfortunately become expedient.

The retentive apparatus is undone and reapplied as seldom as possible ; and at each change, the condition of the fracture should be care-

fully observed, more especially as regards accuracy of adjustment. If the survey prove satisfactory, the apparatus is simply reapplied as at first. If distortion exist, the splints and bandaging are to be so arranged as to obviate this ; gradually restoring the normal position.

At the end of the fifth or sixth week—sooner in the young and healthy, later in those of advanced years and debilitated frame—union to a certain extent, by soft and new-formed bone, has occurred ; and our splints may be discontinued. If any œdema exist in the distal extremity of the limb—as sometimes happens, notwithstanding all our care to the contrary—friction is to be employed, with continuance of the bandage uniformly applied. But, so soon as œdema has gone, let all bandaging be thrown aside ; otherwise atrophy and permanent debility of the limb may ensue. The joints, by friction and passive motion, are then gradually brought back to their accustomed freedom of play ; and when an articulation is in the near vicinity of a fracture, it is well carefully to practise passive motion of the joint at each undoing of the retentive apparatus, lest stiffness should occur.

Use of the part must be resumed very gradually ; more especially in the lower limbs. Many a fractured leg has been set free at the ordinary time, of proper length, and void of all deformity ; which nevertheless soon became both shortened and bent, to an extent which impaired both its symmetry and function. The uniting medium is soft and pliable at first, as has already been observed ; and the motto of the convalescent should be "*Festina lente.*"

Compound Fracture.

The wound which renders a fracture compound may be made at once by the fracturing violence ; or subsequently to the fracture, by the sharp fragments protruding through the skin ; or at a more remote period, by suppuration taking place at the seat of fracture, or by sloughing or ulceration of the superimposed soft parts. The most ordinary examples

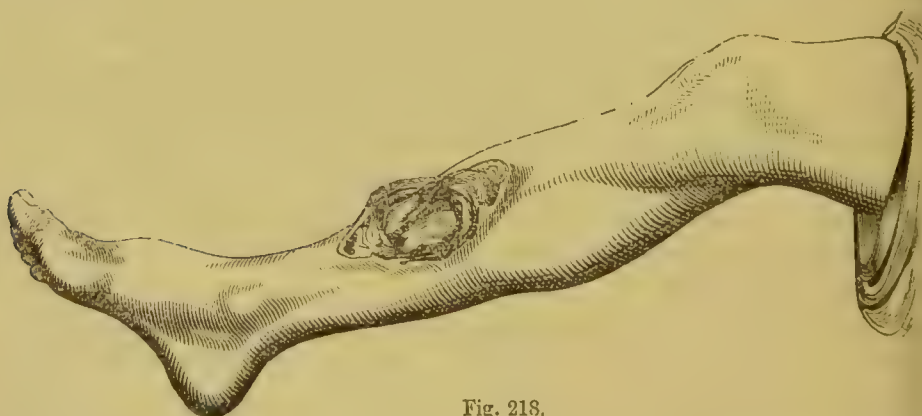


Fig. 218.

are those effected by the two first causes ; and the first is usually the most serious, as implying a great amount of external force applied.

If the opening be but a puncture, or an aperture of small size, made by the sharp and almost cutting edge of the osseous lamella, and if the

Fig. 218. Compound and comminuted fracture of the leg.

inflammatory process be averted, the wound closes at once ; and reparation of the fracture advances in the same way as in the simple form of injury. But when suppuration has become established—as it is certain to be in almost all the cases of severity—the work of repair is altogether delayed, until the inflammatory process shall have abated. The union then is by the second intention, as in flesh wounds. The breach in the soft parts granulates and contracts, discharge gradually diminishing. And at the same time the bone and textures around furnish plastic matter, which, becoming organized and ossified, effects reparation of the fracture ; more slowly, and usually less efficiently, than when no suppuration has occurred ; yet, when the primary destruction of the bone by the force of injury, and the secondary necrosis, by diminished vitality and the access of the inflammatory process, has not destroyed a considerable extent of bone—well enough to restore strength and general usefulness to the part.

The surgeon's first care is, to ascertain whether any attempt should be made to save the limb. In the slighter cases, there is no difficulty ; but in those of severity and complication, much careful and anxious thought, tempered by reference to past experience, is often required, ere a just determination can be attained. In all cases of what may be termed decided doubt, it seems but reasonable that the limb should have the benefit of that doubt ; and that, therefore, adjustment and retention may be instituted immediately, with a view to a tedious yet ultimate cure. When, on the contrary, we are satisfied, both from the appearance of the parts, and from our experience of similar cases, that a cure cannot be procured with the limb retained ; that amputation must be performed, sooner or later, either on account of gangrene, or in consequence of the system's yielding under the hectic of a protracted and profuse discharge, the operation should be at once performed, to anticipate all such certain evils—so soon as the shock of injury shall have sufficiently passed away, and before inflammatory accession shall have begun.

It is not easy to lay down definite rules for guidance in regard to such primary amputations. But the following circumstances may be safely stated as rendering amputation the more prudent course to adopt. Extensive comminution of the bone, fissuring of the shaft, and impaction of fragments in the medulla ; or fracture at several points, or of other bones of the same limb ; extension of the fracture into an important articulation ; an open state of the joint ; much bruising and laceration of the soft parts, rendering extensive sloughing inevitable, with a risk of gangrene invading the whole limb, and with a certainty of extensive and tedious suppuration following separation of the sloughs ; laceration of a large artery, as evidenced either by hemorrhage, or by rapid formation of a large, bloody swelling ; old age ; and enfeeblement of the frame by disease, privation, intemperate habits, or other cause. In most cases it is rather the amount of injury sustained by the soft textures, than by the bone itself, which decides us in resorting to primary amputation in cases of compound fracture. It should be remembered, however, that the nature of the agent inflicting the injury should always be taken into account. Thus, however trifling the injury of soft and hard parts may apparently be, where a railway carriage or truck has passed over the limb, or where a broad-wheeled and heavily loaded waggon, in contra-

distinction to a common horse cart, or spring van, or carriage, has been the agent in producing the injury, we need not doubt that the amount of injury within the skin will of necessity be such as to more than justify resort to amputation. The same is true in the majority of compound fractures produced by gunshot wounds; especially when inflicted with the conical bullet, and more particularly when the thigh is the part injured.

When, on the other hand, circumstances are favourable, and it is determined to save the limb if possible—reduction is to be effected, carefully, gently, immediately; and with due attention to muscular relaxation by position, as in the simple form of injury. If fracture be oblique, and a sharp end of the bone protrude to some distance through a comparatively limited opening in the integument, difficulty is not unlikely to be experienced in effecting the desired replacement; and a question will naturally arise as to whether the wound is to be enlarged or the bone abbreviated. In general, the latter alternative is preferable; for, *cæteris paribus*, the smaller the integumental wound the less the hazard. The projecting portion, therefore, is to be removed, by saw or bone-pliers, to the requisite extent; and, sometimes, to effect this, extension of the wound to a certain degree may be found necessary. Where the bone can be accurately adjusted without the removal of any such extent of bone as implies a considerable hiatus, our care is directed to the integumental injury; which, having been brought neatly together, when at all approaching to the incised in character, is treated for adhesion. Stitches should be avoided, if possible; the preferable retentive agent being adhesive plaster or collodion. And when the wound is very limited, scarcely exceeding a puncture in dimensions, the dressing should be made to cover it completely, so as wholly to exclude atmospheric air; thus rendering immediate union very probable. It is obviously a great matter, if, in the course of the first two or three days, we can succeed by such means in converting a compound into the simple form of injury. But when the wound is plainly bruised, torn, or of such a form that adhesion is impossible, water-dressing is applied in the ordinary way, as suitable for granulation. At first water-dressing is cold, and kept continuously so; for the purpose of allaying and moderating the inflammatory access. The method of irrigation is often very suitable.

Retentive apparatus is applied in the same way as in simple fracture; but with especial care to avoid undue motion, as well as undue pressure or constriction at any part. And the splints and bandages should also be so constructed and arranged, as to leave the wound capable of being readily exposed, for the purpose of inspection and dressing, without any undoing of the general apparatus. For this purpose skeleton wire splints will be found very useful; and, to afford graduated support to the limb during the progress of suppuration, the many-tailed bandage, or a series of slips of bandage, is preferable to the common roller; at all events, in the neighbourhood of the injury. At first, antiphlogistic regimen is more especially necessary than in simple fracture; both the likelihood and the hazard of inflammatory excess being greater. And, should this threaten in a decided manner, general bleeding, antimony, and other active antiphlogistics—purgatives excepted—may be demanded; unless contra-indicated by age, or other debility of system; yet, in severe cases,

always practised with an eye to the ulterior result—the coming period of suppuration and hectic.

When the bone is comminuted at the site of fracture, a question often arises as to the expediency of removing the fragments ; whether they are likely to die, and so to delay the cure, perhaps preventing union altogether ; or whether they are likely to retain their vitality, and so both facilitate the cure and render it more satisfactory when it has occurred. If fragments are completely detached, they should certainly be removed at once ; they are already foreign bodies. If they are well connected, not only by periosteum, but by the surrounding soft parts, they should be carefully replaced and retained in their proper position, with a view towards consolidation. If they are connected only by periosteum, they may be still left, with good hope of reunion, in the young and healthy ; but in the old, and in the case of gunshot injury, they had better at once be taken away. If, at any time, their necrosis becomes certain, they are to receive the same treatment as dead portions of bone under ordinary circumstances ; spontaneous detachment is to be patiently awaited, and then the loose sequestrum is to be lifted away. Sometimes, when necrosis has been slight and gradual, and has occurred late in the cure, so much new bone may be formed as to enact the part of “substitute bone,” and may confine the sequestrum. In this case suppuration will continue, more or less profuse ; the fracture cannot unite ; and the whole frame is likely to give way, by hectic. Still, amputation is not inevitable. Let the principles of treatment applicable to necrosis be carried out ; let the new bone be divided, so as to expose the sequestrum and admit of its removal ; then reapply retentive apparatus, and conduct the treatment in the ordinary way.

When suppuration has become established, is moderate, and limited to the wound, continuance of simple water-dressing is sufficient. When, however, suppuration threatens to become diffuse, or abscess forms in the vicinity, free and early incision is to be had recourse to, with fomentation, and hot epithems, and especial quiet of the limb. In fact, the general principles of treatment suitable to abscess are to be enforced. No squeezing or pressure is at all warrantable, during the acute stage ; if the matter cannot otherwise be prevented from undue accumulation, a dependent counter-opening must be made unhesitatingly.

Should gangrene invade, or plainly threaten to invade, the entire limb during the inflammatory stage, amputation, immediate and high, affords the only chance of safety. Later, when the frame is plainly unable to struggle longer, with a prospect of success, against the hectic cause, amputation is also demanded. A part must be sacrificed to save the whole.

Hemorrhage is sometimes troublesome in compound fracture. It may occur at the time of injury ; an important artery having been punctured or torn. The bleeding point is to be sought for, and secured by ligature, as in ordinary arterial bleeding ; the wound being dilated, if need be—unless, indeed, the arterial lesion be so grave as to render amputation at once advisable.

Or hemorrhage may take place during the progress of cure ; by ulceration, either during separation of the sloughs or at a more remote

period. Or it may be the consequence of an invasion of sloughing-phagedæna. If such bleeding be trivial, evidently proceeding from a vessel of no great magnitude, it may be restrained by pressure, moderately but accurately applied. If on the contrary it be important, and plainly from a vessel of high class, ligature of the bleeding vessel at the bleeding point should unhesitatingly be attempted; only in the event of failure, resorting to restraining pressure assisted by deligation of the main arterial trunk on the cardiac aspect. The process of cure is not necessarily delayed, or rendered imperfect, by the occurrence of such an accident. Should direct deligation fail—as is not likely—or the Hunterian ligature prove insufficient, which is also not improbable—amputation is the last resource; but one which, fortunately, seldom requires to be adopted.

In the case of badly united fracture yet recent, a question may arise as to whether it may not be forcibly disrupted with a view to better adjustment. The answer will necessarily depend on the probable facility and safety with which such a manipulation may be effected: the risks being, non-union, on the one hand, and inflammatory excess on the other. Besides, the force applied may possibly produce a fracture not at the original site. Another consideration of course will be in reference to the existing usefulness and appearance of the limb; much deformity and impairment of function warranting the attempt at amendment, more especially in compliance with an urgent wish on the part of the patient. In some extreme cases it has been thought advisable even to cut down upon the parts, and by sawing off, or out, a sufficient amount of bone, so to effect readjustment, though at the risks inseparable from the compound form of injury.

Diastasis (διαστασις, separation).



Fig. 219.

Sometimes, in the adolescent, an epiphysis is the means of preventing compound dislocation, and determining compound fracture. For instance, when a severe wrench is sustained at the ankle, the natural tendency is probably to compound luxation of the tibia inwards, but the bone yields at the connection of its shaft with the epiphysis; the latter portion remains undisturbed in its place; while the lower end of the shaft, of a transverse and indented aspect, protrudes through the integument. This form of accident is termed *Diastasis*—and is amenable to the same treatment as compound fracture in general. In most cases, it is rather a favourable occurrence than otherwise; the patient being likely to suffer less, and to retain a more useful limb, than after compound dislocation.

Occasionally, diastasis takes place without wound of the soft parts. The condyles of the femur, for example, may be twisted from the shaft. The same treatment is required as for simple fracture; with perhaps more care in both reduction and retention.

Sometimes the diastasis is accompanied with more or less rotation,

Fig. 219. Diastasis of femur. Reunited.

or with splitting up of the epiphysis; an awkward complication, alike difficult of diagnosis and replacement. This form of injury may become secondarily compound, and require, under such circumstances, amputation or excision for its relief.

False Joints.

Ununited Fracture.—A fracture may fail to unite, from various causes. 1. If motion be permitted, and still more if it be purposely practised, daily or even occasionally, the formation of callus will be disturbed, and the formation of the uniting medium is likely to be altogether frustrated; the part will probably remain pliable. 2. Or the parts may be duly adjusted and retained, and reunion may fail by excess of the inflammatory process, in any way induced; suppuration being quite as adverse to the process of healing in bone, as it is in a wound or ulcer of the soft parts. Necrosis, as already stated, is an insuperable obstacle, until the dead portion has been extruded. 3. From constitutional defect, or atmospheric accident, there may be a want of effort in the part; the uniting medium is deficient, and what is produced is but imperfectly organized. The last, however, is by much the most rare occurrence of the three.

It may happen that a portion of the soft parts—as a slip of muscle—has become lodged between the fragments. This has in some cases been found to constitute the obstacle to reunion. Age, also, and long sustained habits of intemperance, are sure to delay, and sometimes may prevent the cure.

Disunited Fracture.—A fracture, having been consolidated in the ordinary way, may again become loose and movable. This may be the result of fresh mechanical violence, occasioning immediate disruption of the connecting medium. Or it may be a more tardy but equally certain process, the result of inflammatory excess—induced by a less degree of external violence, or by any other cause; as a wound, recently united by adhesion, may be made to gape, even wider than before, by the accession of suppuration and ulceration. Or the disjunction may be the result of constitutional disorder, entailing a remarkable tendency to absorption of all recent structures, whether in the hard or soft tissues; as is not unfrequently experienced in connection with scurvy.

The *False joint* which results either from disunited or from ununited fracture, bears no true resemblance to normal articulation.

There is neither articular cartilage nor synovial apparatus. The ends of the bone taper somewhat, and are rounded off; they are invested by a dense fibrous expansion; and by a similar texture



Fig. 221.



Fig. 220.

Fig. 220. Ununited clavicle. The two portions of bone are merely connected by ligamentous substance.

Fig. 221. False joint in the fore-arm. The bones play on each other, by a new hinge-like joint.

of motion is abundantly favoured ; and a limb so circumstanced is, if unsupported by extrinsic aid, almost wholly useless as an organ either of prehension or support. The occurrence is more frequent in military than in civil practice ; for two very obvious reasons. First, in the field, means for duly conducting the treatment of fracture are less available ; secondly, the bruising inflicted by shot-wounds is inimical to satisfactory processes of cure, both in the soft and in the hard tissues.

Treatment of False Joint.—To undo the apparatus of a fractured limb, and to find the solution of continuity in the bone still unrestored, at the end of four, five, six, seven, or eight weeks, is no demonstration of the expected union having altogether failed. It may be that the formation of new bone, though slow and imperfect, is yet in progress ; and, if undisturbed by movement of the limb, this may be completed in no unreasonable time.

Supposing then, that on removal of our splints, at the end of the accustomed period of probation, we find the broken ends still movable on each other, it is manifestly our duty to re-apply the retentive apparatus with still greater care than formerly, and to keep it so applied for a considerably greater period than was at first contemplated. Not until a reasonable period of probation—say four, five, or six months—for the construction of the essential part of the uniting process, shall have passed away, does the surgeon abandon either the careful use of his simple retentive apparatus, or the hope of cure.

In regard to this form of “ununiting fracture,” there need be no two opinions as to the right mode of treatment ; namely, to put up the limb afresh, to keep the parts immovable, and to maintain the general health and powers of system in as vigorous a condition as possible. The immovable starch apparatus is here extremely suitable ; which permits, at the same time, the general health to be attended to, by enabling the patient to move about. In the treatment of such cases, diet is generous ; and even stimuli also may be necessary.

But when, at the end of four, five, six months, or more, we find the limb still loose and movable at the site of fracture, it is a sign that the ordinary process of reunion has failed in all its parts. And the same conclusion is forced upon us in cases of an earlier date—six or eight weeks only, it may be, after the accident—when mobility is great, when a space defective in everything like restorative means can be felt between the ends of the bones, and when these can be plainly felt blunt, tapering, and rounded. In such cases it is, that difference of opinion prevails as to the best modes of treatment, and latitude exists as to their selection.

It naturally occurs to one, that it would be desirable to restore something like the state of matters which occurs at the first, immediately after the injury has been received ; so that we may start again in treatment *de novo*. Accordingly, among other plans, it has been proposed (White) to expose the part by incision, to saw off the ends of the bone, and then, closing the wound, to re-adjust all carefully. Thus is a recent fracture re-established no doubt, but now it is a compound one ; and, being so, it is by no means an improvement on the original casualty. The proceeding is obviously—by bringing life into hazard—too severe, in the recent and otherwise minor cases, and should be regarded as reserved

for such cases as defy the use of milder measures ; besides it must be remembered that when resorted to it has been found to fail. When employed, the use of the bone-cutting pliers will be found more serviceable, as well as more satisfactory in the result, than the application of the saw.

When the principle of "subcutaneous incision" came into use, the idea struck me that this important addition to surgery might be made available towards the remedy of ununited fracture ; and accordingly I proposed that a strong narrow knife, passed obliquely down to the part, should have its edge freely moved about in all directions, so as to cut up the ligamentous bond of union, as well as the dense investment of the ends of the bones ; the knife being then carefully withdrawn, and the puncture covered by plaster or collodion. The parts will probably be reduced to a state very similar to what attends on ordinary fracture at the first. A pouch of blood will form ; the blood will be absorbed ; plastic matter will take its place and become organized, while, at the same time, secretion and organization may advance from the ends of the bone, and consolidation, as by regular callus, be completed.

The connecting materials of the "false joint" are disrupted and excited, not destroyed. They are valuable towards the formation of bone, when brought into and maintained in a state of moderate inflammatory change.

My own experience,* speaks in favour of the practice. It is surely better than—though somewhat like—the practice of John Hunter, whose treatment of an ununited fracture of the humerus, Mr. Samuel Cooper tells us, was as follows :—"There was an artificial joint, and he made an incision into it ; and then having introduced a *spatula*, he irritated the whole surface of the artificial joint. This brought on considerable inflammation, which ended in ankylosis, and the patient was cured." The subcutaneous puncture and the narrow knife, if they are likely to obtain the same ultimate result, are surely preferable to the incision and the spatula. Failure of the method, in the hands of others, I am inclined to attribute to too great gentleness in the use of the knife's point between the bones. There it can scarcely be used too roughly, provided it is kept clear of the vascular and nervous trunks.

Rubbing the ends of the bone rudely together, and then re-applying retentive apparatus as before, has hitherto given no encouraging success, where the careful use of absolute repose has been previously tried. Dr. Physick's seton is less formidable than the saw ; but chance of failure with it is not slight ; and in fractures of the lower extremity, indeed, its success may be regarded as only the exception to the general rule. Mr. Amesbury applied continuous and severe pressure

* Monthly Journal of Medical Science, June 1848. In one instance, this method succeeded, quite beyond my expectation, in consolidating an ununited fracture of the humerus, which had sustained compound injury about ten months before. The bones overlapped, and could not be adjusted. Altogether the case was so very unpromising as led me to remark, while performing the subcutaneous puncture, that it was an unfair test of the practice ; and that, under such circumstances, a successful issue could scarcely be expected. Yet, on the first undoing of the splints, five weeks after the puncture, the parts were found quite firm.

on the parts, so as to force and retain them in accurate re-adjustment ; but his system has not come into vogue, and is rather looked on as painful, irksome, and uncertain. Dieffenbach exposed the bone by incision, drove a peg of ivory into each extremity about half an inch from the line of fracture, and then by wire firmly and closely connected the two ; expecting that the foreign body would rouse a plastic change which would abundantly suffice for consolidation of the fracture now so accurately retained. Experience has spoken favourably of this practice, so far as the induction of a sufficiency of osseous change is concerned ; formation of new bone being established similar to what takes place in necrosis. But in not a few cases much more than enough has been done in that direction ; and even amputation of the acutely suppurated limb has failed to save life. Mr. Burman has employed galvanism as an exciting agent, and with success, in the case of an ununited fracture of the tibia of fourteen weeks' duration.* There were other means at work, however ; namely, an improved diet, and constant firm pressure on the fractured ends. To the method by subcutaneous puncture galvanism might prove a powerful auxiliary. The simultaneous use of both is not incompatible ; and, in these days of anæsthesia, the repetition which either might require cannot be considered as cruel and objectionable. From neither, conducted with ordinary prudence, can risk of untoward casualty be feared.

Should the method by seton be preferred, a caoutchouc tape, or skein of silk, cotton, or iron wire, is inserted between the ends of the bone, and permitted to remain there for some days, until a sufficient degree of irritation has been excited.

On the whole, perhaps, the following statement will express the right sequence of practice. In recent and favourable cases, place the limb in starch bandages, with or without subcutaneous puncture. In more advanced and pronounced, but yet favourable cases, employ subcutaneous puncture, freely, and perhaps with repetition. In the least favourable cases—more especially if these other means have failed—cut out the ends of the bone, using the bone-pliers very freely for this purpose ; and should this fail, or the case seem better suited for it, resort may be had to the use of steel or ivory pegs ; but with caution.

When non-union is obviously dependent on the impaction of a slip of muscle between the fractured ends, or on the presence of a piece of dead bone, or on the lodgment of a foreign body from without, immunity from motion, with attention to the system, after removal of the cause, usually suffice for cure.

Of course in no case is local treatment exclusively to occupy our attention. Constitutional management must never be overlooked ; and often it proves of the highest importance.

Should cure of the false joint fail, palliation may be obtained, and the part rendered tolerably useful, by the application of a tight, unyielding, broad belt, or ferule over the part.

In some extreme cases, the state of matters is so inconvenient, and at the same time so manifestly hopeless, by reason of irremediable displacement, or loss of substance, as to warrant recourse to amputation.

* Monthly Journal, Feb. 1848, Retrospect, p. 12.

Treatment of Deformity after Union has taken place.

When the union is still "green," the best plan for rectification is to effect a complete breaking up of the callus by main force, so as to admit of readjustment, and the application of means suitable to retention of the broken bone in its proper axis and position. As this is a painful proceeding, and one which the muscles of the limb can combine under the influence of pain very successfully to resist, it is well, before proceeding with it, to place the patient completely under the influence of chloroform, and even to effect division of any tense tendinous or fibrous tissues by tenotomy. In some cases again, this process of rectification can better be effected, gradually, by means of simple wooden splints carefully adjusted ; or, in some cases, by a special apparatus, jointed at the seat of deformity, and acting upon each portion of the broken bone by means of a circular rack moved by an endless screw. In other cases, where a large irregular mass of callus surrounds the site of fracture, resisting our efforts to break up the bone or undo its deformed position, the use of a seton has been recommended. This is passed through the callus, and retained until such a degree of inflammatory effect follows, as shall secure a softening of the bond of union sufficient to admit of gradual rectification by means of an apparatus satisfactorily applied. Where the union has become almost complete, something more is required ; and, short of amputation, which should be reserved for altogether hopeless cases, two plans of procedure offer themselves for our choice. Either to cut down upon the bone at the seat of deformity, and divide it by means of the saw or bone pliers ; or should the mass of new bone be very great, to cut out an angular portion of such size, that when the cut surfaces come flatly in contact with each other, the line of the original axis of the bone shall be restored. After either of these procedures, the limb must be suitably arranged for complete repose, and treated as for compound fracture. The constitutional irritation, and the local results of the inflammatory process following upon the operation, are rarely so severe or so untoward as what occurs in a fracture which was originally compound in its nature. This is to be accounted for by the comparatively trifling degree of injury inflicted by the operation upon the vitality of the parts implicated, and upon the system at large ; as also by the degree of condensation of the areolar textures around the bone, due to previous chronic irritation, limiting the tendency to extension of the inflammatory process which is now more acutely established.

CHAPTER XXIV.

DISLOCATION.

DISLOCATION, or Luxation, denotes displacement of a joint, the bones remaining entire. Some joints are more liable than others to such injury ; first, those of the ball and socket construction, as the shoulder and hip ; next, the ginglymoid, as the elbow. And, again, the articulations most exposed to external violence are necessarily the most liable to displacement.

Dislocations may occur at any age ; but are most frequent during the middle period of life. In advanced years, fracture is more common. In early adolescence the accident is rare ; and yet examples are not wanting. Even at five years of age, dislocation of the hip has happened in an ordinary way.*

Congenital Luxations are by no means rare ; and are of different kinds. 1. *Obstetrical* ; the result of accident by force in delivery. 2. *Spontaneous* ; caused by articular disease in utero. 3. *Functional* ; by functional disorder of the muscles, dependent on derangement of the nervous system in utero. As in clubfoot. 4. *Original* ; by arrest of development ; the articulating apparatus being incomplete.†

The *Causes* of ordinary luxation are, first, *Predisposing*. Peculiarity of construction and site, as just stated, may be said to be of this class. Also, weakness of surrounding muscles plainly favours the occurrence. The muscles afford much support, even in the dead body, to the joints ; and any articulation, which lacks that accustomed aid, will be especially liable to dislocation. The joints of atrophied and paralysed limbs, consequently, are in especial danger. Undue elongation of the proper articulating apparatus also predisposes ; whether this be the result of external violence—as in the case of over-extension—or of chronic disease. Accumulation of fluid in a joint predisposes, particularly in those of ball and socket construction ; inasmuch as the ligamentous tissues by which the articulating ends are kept in apposition are thereby stretched. Destructive disease of joints manifestly tends to their displacement, as formerly stated ; only a slight force being sufficient, when the retentive structure has almost all fallen before ulceration. One act of dislocation predisposes to another. A joint, once luxated, is especially liable to re-displacement ; for the muscles have been weakened, the articulating apparatus has been stretched and elongated, and the latter, too, may be yet deficient at the part where the end of the bone formerly escaped.

The *Exciting causes* are, like those of fracture, external violence and muscular action. A blow or fall, as was stated, may occasion fracture,

* Lancet, No. 1280, p. 285.

† British and Foreign Review, No. xlii., p. 393.

whether the force be applied directly or indirectly ; most frequently the break is from direct violence. Dislocation, in like manner, may be produced either directly or indirectly ; but is most likely to occur when the force is indirect—applied at the end of a long bone, and operating indirectly on its further extremity. Thus a patient, falling directly on the shoulder or hip, is most apt to suffer fracture. Whereas when he falls on the hand or foot, knee or elbow, and the injury is sustained at the hip or shoulder, it is more likely to be dislocation. The muscles surrounding the joint, were they, on application of the violence, to act all at once, in unison, would doubtless support the part, and oppose the displacing agency. But one or two, acting with suddenness and energy, will plainly tend rather to favour the occurrence of dislodgment, as well as to determine the direction in which it is to take place. Again, muscular action, alone, may effect luxation ; as in the case of the lower jaw, dislocated by yawning ; also in those cases in which there is naturally much laxity and elongation of the articulating apparatus, and in which, consequently, the patient may have almost a voluntary power in effecting displacement.

When the accident results from muscular action alone, or in consequence of relaxation of the ligamentous apparatus, there is seldom any laceration of muscle, ligament, or tendon. But when it is produced by external violence, sudden and severe, operating on a part previously in a normal state, there is usually a giving way, by laceration, of the capsular ligament, and of muscular fibres exterior to it—those which may happen especially to oppose the displacement ; tendon, too, may be either ruptured or torn away from its osseous insertion. Such disruption of the parts exterior to the joint, doubtless, aggravates the nature of the injury, and favours extensive displacement ; but, at the same time, fortunately, reduction is by the same circumstances facilitated.

The *Symptoms* of dislocation are :—signs of displacement, more or less obvious ; a swelling where none should be, or a hollow where the surface should be even or raised ; shortening or elongation of the limb, as the case may be—more frequently the former. Much pain is complained of ; particularly if a nervous trunk or plexus be compressed by the head of the bone ; as in dislocation of the humerus into the axilla. And, usually, the patient is found, immediately after the accident, labouring under a marked shock or depression, often severe. Motion is much impaired. The patient cannot raise or move the part ; neither can the surgeon ; and any attempt to do so, on the part of either, is attended with great increase of suffering. The part is locked and fixed ; most especially after some hours have elapsed. At first, the peculiar immobility may not be very distinct, in consequence of muscular relaxation attendant on the shock ; particularly if the patient happen to be by no means of a robust and muscular frame. But when the state of depression has passed away, spastic rigidity seizes on the muscles implicated in the hurt ; and by them the bone is locked firmly in its new and unnatural situation. There is swelling, as in fracture ; at the first, from bone being where no bone should be ; subsequently from more or less sanguineous infiltration, or accumulation ; and, more remotely, from the products which attend on an aroused inflammatory process. On at-

tempting motion, the bones are found entire in their continuity; the head moving obediently with the shaft. No crepitus is felt; but there may be a simulation—of a soft, sloppy, oozy character; wholly distinct

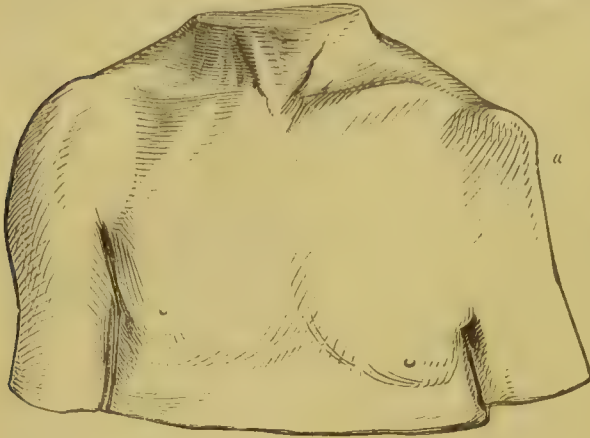


Fig. 222.

from the dry, rough, crepitus of fracture, and never to be mistaken by an experienced hand or ear. Sometimes, however, there is an obscure and true crepitus on the surface of the part; from movement of osseous scales which may have been torn off the muscular or tendinous insertions. Nerves may be compressed or torn across; and numbness, or complete local

paralysis, will ensue. Compression is more frequent than laceration; and, consequently, temporary numbness is more common than complete loss of power. Or, again, a certain nervous branch may be torn, while the principal nervous trunks are but temporarily inconvenienced; and while the limb generally may recover its nervous influence, immediately on reduction, one part may remain deficient, either for a time or permanently. Thus, in dislocation of the shoulder, the circumflex nerve is apt to be seriously injured; causing paralysis of the deltoid.

On simple extension being made, the proper length of the limb is not restored, as in fracture. This is effected only by energetic extension, producing reduction; and, when effected, the limb remains of its due proportions; there being no reproduction of displacement by muscular action, on mere cessation of extension, as in fracture. Usually, also, there is an obvious change of relative position; affecting not only the part, but the whole limb. In the common dislocation of the hip, for example, not only is the trochanter major changed from its normal relative position, but also the toes and limb are turned remarkably inwards. And this change of relative position cannot be altered by gentle manipulation, as in fracture; but only after reduction; and then the restoration is permanent.

It is obviously of the highest importance, that in suspected luxation our diagnosis should be prompt and accurate. An immediate and careful, determined, yet gentle examination is therefore to be made; if possible, before either inflammatory or bloody swelling has ensued. The sooner we determine the nature of the accident, and the sooner suitable



Fig. 223.

Fig. 222. Dislocation of the shoulder. The flattening shewn at *a*. The right shoulder is normal.

Fig. 223. Dislocation of the elbow; shewing preternatural fulness in front, below the natural fold of flexure of the elbow.

treatment for reduction is adopted, thereafter—when satisfied as to the existence of a luxation—the better it is for both patient and surgeon. The longer the period which elapses between infliction of the injury and the attempts at reduction, the greater are the difficulties and dangers which are to be encountered.

Anæsthesia contributes greatly to accuracy of diagnosis ; obtaining two most important results. The patient suffers no pain, however free or protracted the examination ; and, the muscles being thoroughly relaxed, the surgeon performs his manipulations with as much facility as on a dead body. Besides, it is not unlikely that subsequent inflammatory accession will prove less than if the examination had been made on a suffering and resisting patient.

Dislocation of the hip may be simulated by morbus coxarius ; but inquiry into the history of the case will sufficiently guard the practitioner against error. It is between fracture and dislocation that we are likely to be most in doubt. And it may be well here to repeat, shortly, the leading points of distinction. In dislocation, there is no true crepitus ; motion, both voluntary and involuntary, is limited ; the bone may be traced, entire, throughout its whole extent ; simple extension will not restore due length to the limb ; change of relative position is distinct, and, like shortening of the limb, cannot be altered aright until reduction has been effected—and then the alteration is permanent ; application of the displacing force is usually indirect. Also, it is not unimportant to remember, that fracture is most common at an advanced age ; while dislocations are seldom found but in the adolescent and adult, and most frequently in the latter.

Occasionally, dislocation is complicated with fracture. The fibula is usually broken in dislocation of the tibia ; in dislocation of the hip, the acetabulum may be either chipped, or broken through ; in dislocation of the elbow, the coronoid process of the ulna may be detached. And examination of the injury should always be conducted with a view to the possibility of this occurrence. For if fracture co-exist, the retentive means must be much more carefully adjusted and maintained than in simple dislocation.

The consequences of dislocation are important. The muscles—at first relaxed, during continuance of the shock of injury—become rigid in a few hours ; and, if unopposed, tend, as in fracture, to resist our efforts to reduce the displacement. After a time, they accommodate themselves to their new relative position. If stretched by the displacement, they become permanently elongated : if relaxed, they become actually shortened, and condensed in bulk. If a muscle or tendon have been detached from its origin or insertion, it becomes fixed anew, by plastic change. If muscular fibre have been torn, the space is filled by an adventitious structure of ligamentous appearance and density ; for some time more bulky than the vacancy which it is intended to occupy. The rent in the capsular ligament, as well as that in the exterior fibrous apparatus, becomes closed by adhesion to adjacent parts. A new cavity of reception begins to be formed for the displaced bone. If it rest on muscle, this becomes dense, ligamentous, smooth, and lubricated ; hollowed of a suitable form, for the play of the bone. If it rest on bone, a cavity is

formed there for its reception and play ; partly by interstitial absorption, partly by new formation around. And the surface of this new acetabulum, or glenoid cavity—as the case may be—becomes invested by dense ligamentous structure, well lubricated ; which forms an excellent

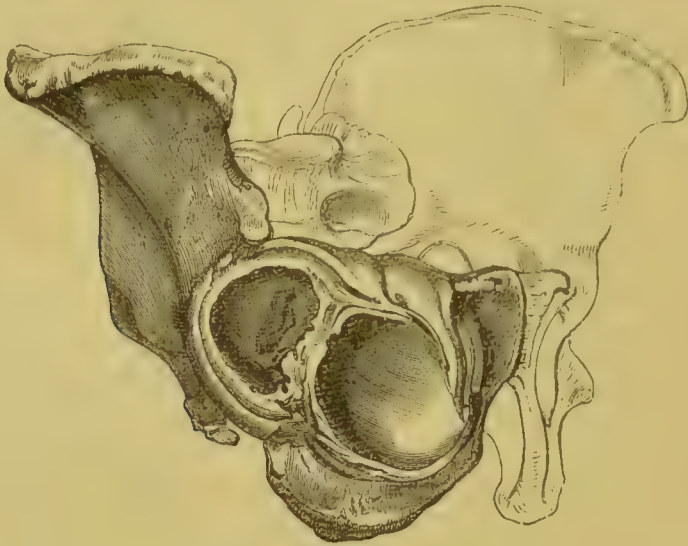


Fig. 224.

imitation, both in appearance and in function, of the normal articular cartilage. Not unfrequently, however, porcellanous change takes the place of the membranous investment. The displaced head of the bone, too, itself undergoes alteration ; parting with its cartilage, flattening, and suiting itself generally to its changed circumstances. At the same time, the original articulating surface, now left unoccupied, begins to change ; but the change is slow and long deferred. After many months, nay after years of vacancy, the glenoid cavity has been found in such a state of suitableness, and so little altered from its original structure and dimensions, as to admit of replacement with complete restoration of function ; and without any long time being required for re-establishment of the former freedom and extent of motion. In a macerated pelvis, evidently obtained from a patient who had lived long after the occurrence of dislocation, I have seen two acetabula in close apposition ; the one original, the other of adventitious formation ; and both apparently of almost equally efficient capabilities. After a time, however—various in different cases, yet never brief—the original articulating surface does change materially. Its cavity is filled up, and its investing cartilage disappears ; its projections are rounded off by absorption ; it becomes incorporated with the surrounding soft parts ; and these changes take place all the more speedily and effectually, if the new articulating surface be in its immediate vicinity, and encroach on its boundary. There seems good reason to believe, also, that the less the synovial capsule has been injured, and the more freely it continues its secretive power, the less speedy and complete are the obliterative changes in the original structure.

Treatment.—The paramount indication is *Reduction*, and cannot be attempted too soon. It consists of *extension*, to move the bone from its

Fig. 224. Old dislocation of the hip. A new acetabulum formed ; while the original is but little changed.—SIR A. COOPER.

abnormal position, and to bring it on a plane with the articulating surface it has left; *counter-extension*, to steady the latter part, and to admit of extension being satisfactorily effected; and *coaptation*, to replace the surfaces in apposition. If the patient be seen immediately after infliction of the injury, still faint, with all his frame prostrate and relaxed, and incapable of throwing any part of his muscular system into strong resisting action—reduction may be expected to prove comparatively easy. The surgeon is able to cope with the accident single-handed. In the case of the shoulder, for example, he takes hold of the elbow with his right hand, and gently extends the arm; while, with the fingers of his left hand, he pushes the head of the bone towards the glenoid cavity. After moderate extension, he makes a sudden, combined, jerking movement; and usually succeeds.

But when hours and days have passed, the obstacles to reduction are ever on the increase. The muscles are first spasmodically rigid, and then they leisurely adapt themselves to their new position; the track from the original articulating surface, through the lacerated ligamentous apparatus, is becoming more and more obliterated by adhesion; and the displaced extremity of the bone is busy accommodating itself to the parts with which it is now in contact. Sometimes, the head of the bone merely projects through a narrow fissure of the capsule; and this, tightly embracing the bone's neck, becomes agglutinated to it, constituting a most serious obstacle to replacement.

Such being the impediments to reduction, the indications towards its attainment become very plain. By gradual yet powerful extension, muscular resistance must be overcome; by free rotation and movement of the end of the bone, new adhesions are to be broken up.

If only a few hours or days have elapsed, extension may be effected by the surgeon himself; or by the dead weight of several able-bodied assistants. But, when the time elapsed is considerable, it is right at once to employ mechanical aid; making extension by laque and pulleys; and so employing a less force with more steadiness and precision. A sudden pull and jerk may often succeed in a recent case; they never can, in one of some duration. In such, suddenness and intensity of violence are never warrantable; for these are as likely to rupture muscles, arteries, or nerves, as to effect replacement of the bone. The muscular resistance is to be gradually exhausted, by constant and steady extension—determined, yet not violent. When this has been patiently effected, free movement of the end of the bone is made, to clear off adventitious hindrances; and then coaptation is attempted, as in the recent case. It is a common error to commence attempts at coaptation at the same time with extension. Only after the muscles have been thoroughly exhausted by extending force, indirectly applied, should the surgeon's hand come to decided manipulation of the injured part.

Extension by pulleys is made thus:—The patient is usually recumbent, on a mattress on the floor. A broad belt is passed under the perineum, or over the chest—according as it is the upper or lower extremity that is injured—and is secured behind the patient to some fixed point on the wall or floor; in order that thus *counter-extension* may be sure, and the patient fixed in his place. And be it remembered, that

until the measures for counter-extension are efficiently provided for, there is no use in proceeding with our efforts to effect reduction. A *laque*, or noose, is put upon the affected limb; a damp bandage or towel having been previously wrapped tightly round the part, to prevent its excoriation. This laque usually consists of a stout band of worsted, secured by what is termed the clove hitch; the advantage of which is, that while it holds a firm grasp, it cannot be tightened by pulling so as unduly to constrict the limb. To the laque the pulleys and rope are attached

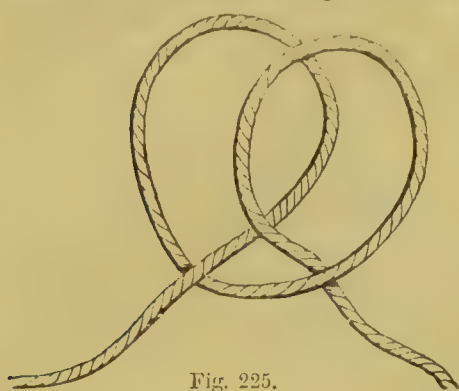


Fig. 225.

by a hook; the other hook is secured to a fixed point opposite the patient; and then the rope is steadily pulled, as the surgeon may direct. Instead of the laque, a circular collar of leather well padded on the inner aspect may be adapted to the part, and tightened by a screw; but the former is more convenient, and fully as efficient. A question may arise as to the point of its application. If attached to the distal end of the *bone* affected (preferred by British surgeons)—as above the knee, in dislocation of the

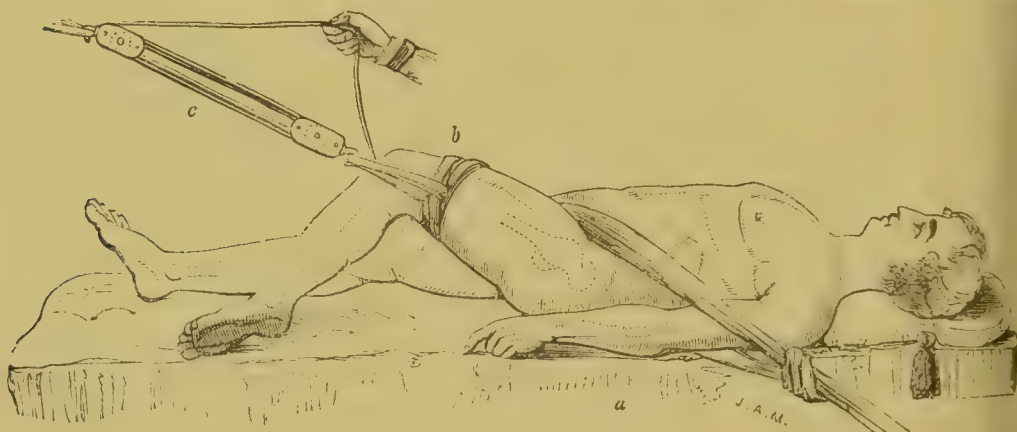


Fig. 226.

hip—extending force is exerted more directly, and with greater power, on the displaced bone; and, from bending of the leg being permitted, the desired rotatory movements of the head of the bone can be more readily and powerfully performed. Yet it may be, that a near application of the noose may have the same effect as too early attempts at coaptation; stimulating the implicated muscles to resistance of the extending power—more especially if the patient should emerge from the deep stupor of chloroform; and, at any period, by compressing the muscles which we desire to extend, in some degree interfering with the efficiency of the extension. If attached to the distal extremity of the *limb*, on the contrary (preferred by French surgeons)—as above the ankle, in the example referred to—the extending force is indirect, and loses somewhat of its power by transmission through the intervening knee-joint;

Fig. 225. The clove-hitch; shewn on a coil of rope.

Fig. 226. Mode of reducing dislocation shewn. At *a*, counter-extension made; at *b*, the laque attached to the thigh; at *c*, the pulleys.

also, rotation is perhaps less easily effected. But at the same time an obvious advantage results, from the great length of lever which can then be employed in moving the head of the bone. On the whole, the former position of the laque—on the end of the bone—will be found generally preferred; the more especially as now-a-days muscular resistance is likely to be annulled by chloroform.

The direction in which the extending force is to be applied must vary according to the nature of the individual dislocation.

But the patient is not at once to be attacked by mechanical force. There are powerful auxiliary means which are invariably to be used, in the first instance, in all cases where difficulty of reduction is anticipated. The less force employed, the less severe and hazardous will be the reductive efforts. We shall avoid the risk of rupturing muscle, artery, vein, and nerve, or of at all events so injuring the parts as to kindle an active inflammatory process in them. The muscular system may be overcome by other means than an extending force; means not directed to the part, but to the whole frame. We imitate the state in which the patient is found immediately after infliction of the injury; when the opportunity is so very favourable to reduction, by reason of the prostrate and unresisting condition of the whole muscular system. The patient is to be temporarily enfeebled. A large bleeding from the arm will effect this; but the same object may be obtained without waste of the precious fluid; and, therefore, such other means are preferable. The patient may be put into a warm bath, and kept there till faintness ensue; or tartar emetic may be given in repeated doses;* or tobacco may be administered—in the form of enema—until the desired effect has been obtained. Or, incomparably the best of all—chloroform is inhaled, until the full effect of deep anæsthesia is produced; when every voluntary muscle becomes relaxed as if in death. And thus the double advantage is obtained, of procuring muscular relaxation, at once more thorough and more temporary than by any other agent; while at the same time an otherwise very painful operation is completed on a quite unconscious patient. Besides, there being seldom any necessity for applying much force, to extend muscles already so much relaxed, the risks by tear and subsequent inflammatory excess are greatly diminished.

The procedure to be followed, therefore, in cases of old standing is:—first to overcome the patient's muscular frame, and then to apply extending force, by laque and pulleys, in the right direction; extension being made from the distal extremity of the bone or of the limb, as circumstances may seem to indicate. When extension has been steadily continued for some time, the implicated muscles plainly yield, the head of the bone becomes more loose and movable, and approaches the plane of the articulating surface which it left; then rotation is to be practised freely, in order to remove those adventitious hindrances, by plastic product and adhesion, which may oppose replacement. And this having been done, by coaptating movements of the surgeon's hand, the head of

* The native Indians are well acquainted with this practice. "In cases where they do not succeed readily, they nauseate the patient to a most distressing degree, and then find no very great difficulty in reducing the luxation."—*Monthly Journal*, April 1846, p. 306.

the bone is guided towards its normal position. The act of reduction is usually sudden ; indicated sometimes by a distinct snap, but more frequently by a peculiar grating sensation, unattended by noise, as if a muscle, or the bone itself, had given way. The proper length of the limb is immediately restored, and normal relative position re-established.

In obstinate cases, a sudden slackening of the extending cord—combined with a jerking, coaptating movement of the surgeon, at the joint—greatly facilitates, in truth may effect, reduction. An ingenious device for suddenly “letting go” the extension force, has been for several years in use in the Aberdeen Infirmary, the invention of an ingenious student of that school. It consists of a pair of calipers or “shears” made of tough steel. These are hinged to a bar which connects them with the pulleys, while the laque is held by a steel hook, which is in turn “kept” by the ellipsis formed by the opposition of the two branches of the “shears.” When the surgeon desires “to let go,” by pressing down a small lever, a hook hinged to the one branch is displaced from its hold upon a pin, fixed upon the other arm of the instrument, and thus the continuity of the shears is immediately dissolved, permitting the blades to gape and the steel hook to glide from their embrace.

During extension—if anæsthesia be not employed—it is well to engage the patient in a sustained conversation ; insisting upon his answers ; in order that he may not, by deep inspiration, make his trunk a fixed point on which muscular resistance may be raised.

So soon as the signs of reduction have occurred, the extending force is instantly desisted from.

It may happen that after patient extension, rotation, and coaptation, our efforts are unsuccessful ; and yet the muscles are lax and passive ; the head of the bone can be moved freely ; it can be brought to the plane of the deserted articulating surface—and still it refuses to enter. In the case of the acetabulum, it may be the brim of the cavity which proves the obstacle ; and, by a jack towel placed under the thigh, the bone may be jerked, tilted, or lifted over that last obstruction into its place.

But even this last-mentioned addition to the reductive means may fail. Under such circumstances, it is plainly the formation of adhesions that constitutes the obstructing cause ; and if very free rotation have failed to overcome this, the case may possibly be suitable for resorting to the subcutaneous section of the opposing tissues. A strong tenotomy knife, with a long shank, may be introduced, and moved in such a direction as to clear an open passage towards the articulating cavity. The puncture having been carefully closed, the extending force is to be re-applied ; and the coaptating means will then most probably succeed, and that readily. Still it must be remembered that there is a certain amount of risk in this procedure ; and that three things are necessary to warrant its adoption—namely, failure of all other simpler means, tolerable certainty of accomplishing the object in view, and rational consent of the patient.

In regard to old luxations, an important question arises, as to the time at which attempts at reduction cease to be warrantable. For after a considerable period has elapsed, the new articulation becomes very serviceable, and the old may have begun to be effaced. Then attempts

at reduction, even the most strenuous, are likely to fail ; and having failed, the patient is left in a much worse plight than before—the normal state not re-established, while the new adaptation is interfered with and arrested in its progress. Perhaps inflammatory mischief may be lighted up, and even, though rarely, abscess ensue ; at all events, there is much painful swelling, the partially recovered power of motion is once more undone, and weeks or months may have again to elapse ere the part become so quiet and so useful as it was before the unfortunate attempt.

Some joints are more favourably situated than others, in this respect. Hinge joints, as the elbow, are with difficulty reducible after three or four weeks have elapsed. On the other hand, a ball and socket joint, as the shoulder, may be practicable after many months ; but this too has its intrinsic difficulties, due to the extreme mobility of the scapula, and the consequent inefficiency of all measures for counter-extension. No definite rules can be laid down. All must be left to the desire of the patient, and the judgment and experience of the surgeon. It being always remembered, that (besides the obvious gains by chloroform) the principle of subcutaneous section, applicable to the vicinity of joints, may enable us to overcome perhaps the most serious obstacles to reduction in cases of old standing—obstacles which are not capable of being in any other way relaxed ; that the original articulating cavity, if not interfered with by the new formation, remains long available ; and that, therefore, the period during which reduction may be attempted is to be regarded as considerably extended, beyond what the older authorities were willing to allow. There can seldom be much propriety, however, in resorting to such measures at the end of more than a year after the occurrence of the displacement ; although a successful result from tenotomy is reported by Dieffenbach, in a case of dislocation of the shoulder, two years after the accident.

In fractures, reduction is usually easy ; while *retention* is accomplished not without care and trouble, and often with difficulty. Such matters are reversed in dislocation. Reduction is difficult, retention easy and simple. It is usually sufficient to bind down the limb to the trunk or its pillow gently ; so as to prevent any movement favourable to displacement. And when the patient is discreet and trustworthy, even such deligation may often be dispensed with after he has fully emerged from the chloroform. But in old dislocations of shallow joints, retention comes to be a very important indication. In the case of the shoulder-joint, for example, it is often necessary to place a pad in the axilla, binding the arm firmly to the side ; else redisplacement will certainly and immediately occur. Where such facility of reproduction of the displacement exists, the presence of a partial fracture of the bones, implicated in the articulation, may be regarded as certain.

Prevention of subsequent evil, too, is ordinarily accomplished without difficulty. For a day or two after reduction, the patient is kept quiet, and on low diet. The part is fomented ; and, if inflammatory accession occur, leeches are applied. Higher antiphlogistics are very seldom required.

Pain and swelling having subsided, motion is to be gradually and gently restored ; assisted by moderate friction. If a muscle, as the del-

toid, remain weak and flaccid, its contractility may be aroused, and normal development favoured, by powerful and stimulant friction, or by the application of electro-galvanism. Truth to tell, this last indication of *restoration* is in many cases the most difficult of fulfilment. Do what we will, joints sometimes remain long weak and useless.

Dislocation with Fracture.

This is a rare complication of injuries ; but sometimes occurs. As at the shoulder ; the head of the humerus being first displaced into the axilla, while fracture occurs at the neck of the bone. In treatment, the dislocation should first be reduced, if possible, by coaptating manipulation ; and then the fracture may be managed in the ordinary way. Sometimes, as when the fracture is at some distance from the articulation, splints may be arranged on the broken limb, so as to restore its continuity in great measure, and permit ordinary extension to be employed against the dislocation ; of course, so far increasing the chance of success. But if reduction fail, then the fracture must be attended to ; and when it has become consolidated, it is just possible that attempts to reduce the dislocation in the usual way may succeed—all the more as the use of chloroform now gives great facilities in that way. Practically, however, such results are rarely attained. In such circumstances, it has been proposed to act upon the displaced and separated head of the bone by subcutaneous leverage. A puncture is made with a tenotomy knife, down to the head of the bone ; a sharp pointed, highly tempered, steel instrument, resembling a tooth punch, is then employed to penetrate it ; and the hold thus obtained is employed to effect the leverage requisite to restore the bone to its socket.

Compound Dislocation.

This is dislocation with corresponding wound of the integuments ; the displaced bone usually projecting to a greater or less extent. The ankle is most liable to this form of injury.

The same general observations apply as to compound fracture. There is generally less bruising of the soft parts, less chance of arterial laceration, and consequently less likelihood of amputation being primarily demanded. The risk by subsequent inflammatory excess, however, is infinitely greater than in fracture. It is a rare thing when the joint does not inflame acutely and intensely ; the cartilage and bone ulcerating, much pus flowing away, and the system becoming involved in the most severe general disturbance—at first intensely inflammatory, but soon verging towards the asthenic type. On this account, secondary amputation becomes not unfrequently expedient.

It having been determined to attempt preservation of the limb, removal of foreign matter from the wound and articular surfaces first engages our attention. Then the parts are reduced ; the same preference being given to abbreviation of the bone over enlargement of the wound, as in compound fracture. Indeed, removal of the articulating surface which projects, or of both if need be, often seems to be of much service ;

especially in compound dislocation of the tibia, at the ankle, or of the femur, at the knee-joint. Less tension ensues, space for the inflammatory tumescence being considerably enlarged; and, in consequence of the comparative absence of tension, the inflammatory process proves less severe, and less destructive in its results.

Reduction having been duly effected, after excision of the ends of the bones, the wound is brought together; usually without sutures; and retentive means, suited to the part, are carefully and lightly applied, as for compound fracture. Moderation of the inflammatory process, and prevention of other casualties, are also sought for in a similar way. In some cases, especially after practising excision, we succeed in arresting all inflammatory excess; the part speedily recovers, and a certain degree of mobility, where this is desirable, may easily enough be retained by the diligent use of passive motion. In other cases, where the bones have been reduced without removal of the protruding portion—and these constitute the minority—ankylosis results, after a tedious suppuration; perhaps accompanied with partial necrosis. Such stiffness, however, may be to a great extent atoned for, by increased play of a neighbouring joint; in the case of the ankle, for example, tarsal motion becoming unusually extensive. In other cases, as already stated, and these constitute the majority, when excision has not in the first instance been employed, amputation is demanded, to save life.

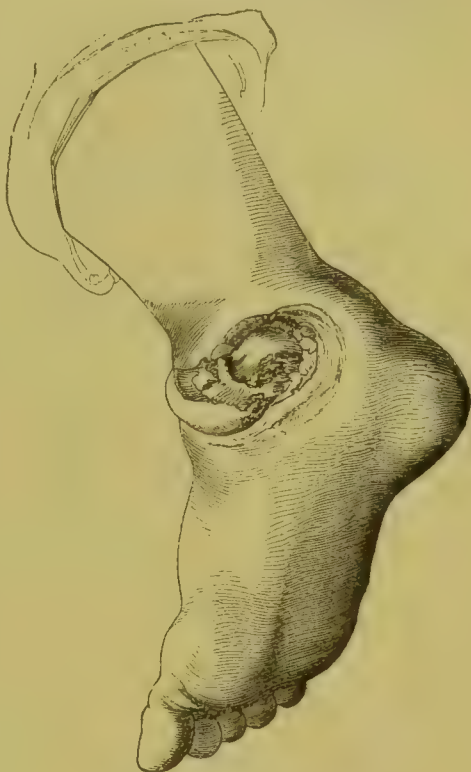


Fig. 227.

Both compound dislocation and compound fracture are especially liable to occur to the intemperate; and, in many cases, an apparently slight injury suffices for the infliction—more particularly of the former accident. *Delirium tremens*, consequently, is apt to prove a sad complication, supervening within a short time after the accident, and usually determining an early and fatal issue.

Subluxation.

By this term is meant incomplete displacement of a joint; the articulating surfaces remaining yet in partial apposition. It is not of frequent occurrence. An example is, partial displacement of the head of the humerus on the coracoid process. The injury may also occur at the ankle. It may also happen at the wrist; the bones of the fore-arm—one or other, or both—being partially displaced towards the palmar aspect.

The causes, symptoms, and treatment, resemble those of dislocation;

Fig. 227. Compound dislocation of the astragalus.—Sir A. COOPER.

in a minor degree. Indeed, as in the first named example, the manipulations which are necessary to ascertain the nature of the injury often suffice almost for effecting replacement. The consequences are usually slight. Retention and prevention are simple and easy.

Some persons have a voluntary power of causing and reducing such partial displacements, by muscular effort ; as in the jaw, thumb, and shoulder. In such cases, there is doubtless an unusual laxity of the articulating apparatus.

CHAPTER XXV.

OF SPRAIN, AND RUPTURE OF MUSCLE AND TENDON.

THE term *Sprain*, or *Strain*, denotes stretching and partial laceration of the ligamentous apparatus of a joint, without displacement of the articulating surfaces. The pain and shock, immediately following, are often as great as in complete luxation; and the former, after a time, becomes much more severe, probably in consequence of the unbroken continuity of the fibrous tissue favouring the occurrence of great tension. Swelling is usually considerable; and is both immediate and secondary, as in other injuries; at first slight, from extravasation of blood; afterwards considerable, from serous effusion into the cavity of the joint, and infiltration, by inflammatory accession, in the tissues exterior. The injury is always serious; painful and troublesome in itself; and apt to lay the foundation of organic change in the joint, of the most confirmed character. The joints least prone to dislocation are the most liable to sprain.

The indications of treatment are; to prevent, diminish, or remove inflammatory accession; to favour absorption of extravasation and inflammatory product; to restore function; and to avert the occurrence of organic change. The joint is to be kept in a state of absolute quietude throughout; commanded by a bandage, splint, or starch apparatus if need be. Cold, continuously applied, may be theoretically the most suitable immediate application; restraining extravasation of blood, and tending to avert inflammatory excess. Notwithstanding, warm applications will generally be more grateful to the patient; leeches, also, are applied—not as recommended, by popular consent, immediately on the receipt of the injury, both in sprain and bruise, to remove the “bruised blood”—but only to check the inflammatory access when it threatens to become severe; opiates and constitutional remedies should also be exhibited, as circumstances may require. After the inflammatory attack has passed away, the part remaining feeble and swoln, gentle friction and pressure are to be employed; with a view to favouring absorption, and so restoring the parts, without and within the joint, to their pristine state. But this indication must, in all cases, be begun and continued with extreme caution; lest a premature and inordinate stimulus be applied, and dangerous excitement recur. As swelling decreases, and all uneasy sensations abate, passive motion is to be employed, with a view to restoration of function; but used with the same caution as the friction and bandaging.

Instead of using plain water, it is well to add a small quantity of the tincture of arnica; cold at first, afterwards warmed or not according to

circumstances ; always keeping the solution very weak, otherwise a troublesome itchy eczema is apt to ensue.

In the thoroughly chronic stage, hard and long continued friction is sometimes of decided service ; suppling the joints, and freeing the play of tendons, by inducing absorption of lingering plastic material. It is at this period of the case—not before—that the aid of professed “rubbers” may be obtained, with good prospect of advantage. The cold douche of salt or fresh water will also be found an excellent means of restoring the parts, more rapidly than otherwise would occur, to their normal condition.

Should the inflammatory process threaten to continue, of a chronic character, the hot douche or even counter-irritation is to be employed ; and the general indications for treatment of disease of an articulation carried out as in ordinary circumstances ; all motion, friction, or other stimulus being carefully avoided.

For some time, moderate bandaging is continued, to afford support ; especially when the part is in use. And, for long after, especial care should be taken to avert fresh injury, or any other cause likely to induce disease. For the joint, notwithstanding all care in the treatment, too often remains both vitally and physically weak ; liable to reproduction of the sprain, and to reinduction of morbid change, from but slight causes. Our prophylactic care will naturally be most sedulous, in those who, from scrofulous, rheumatic, or gouty habit, are especially prone to affections of the joints.

Rupture of Muscle.

Muscular fibre not unfrequently gives way, to a greater or less extent, in those of robust frame, advanced in years, and unaccustomed to muscular effort, when, by circumstances, they are called upon to make sudden and powerful exertion ; as in running, leaping, dancing, or lifting a weight. The muscle most frequently injured thus, is the *gastrocnemius*—or its accessory, the *plantaris gracilis*—at its lower part ; where muscular fibre ends, and tendon begins. The consequences are :—sudden pain ; swelling and discoloration, by extravasation of blood, immediate or apparent some time after ; increase of swelling and pain, by plastic product attendant on inflammatory accession ; lameness ; at first a chasm at the site of injury, more or less extensive, according to the amount of laceration ; afterwards, a hard swelling there, caused by the organized plastic production which occupies the vacant space. At the time of injury, the patient usually has a sensation as if struck on the part, is sensible that something has given way, and falls to the ground.

Rupture of the *quadriceps extensor cruris*, at its lower part, by muscular exertion, is also not uncommon ; and the *biceps flexor cubiti*, the *triceps*, the pectorals, the *recti abdominis*, the *serratus magnus*, the diaphragm, the *psoas* and *iliacus*, etc., may be similarly affected.

The treatment consists of rest and antiphlogistic regimen ; the part being kept in such a position as to relax the affected muscle, and place its several fibres in contact, while the part throughout the whole period of treatment should be firmly supported by a bandage, which is more

particularly required in the case of muscles forming a part of the parietes of the thorax or abdomen. Union is not by reproduction of muscle, but by dense ligamentous texture. For obvious reasons, use of the limb is to be very gradually resumed.

Rupture of Tendon.

Tendon is ruptured, under the same circumstances as muscular fibre. This tissue is more resistful of violence than muscle, and consequently in the tearing away of fingers or other parts by extreme force, long strings of tendon may be seen attached to the severed parts; the muscular tissue having given way, perhaps high up in the remaining limb.

The part most commonly affected by simple rupture, is the *Tendo Achillis*. The symptoms and signs of the injury are similar to those of ruptured muscle, but of a major degree. The pain and swelling are greater; the sensation of injury, and of something having yielded, is more distinct; and not unfrequently the patient states that it is accompanied by a tolerably distinct snap, or other sound, while he feels as though he had received a blow on the part with a stick, or been struck by a stone. The hiatus, at the part, is wider and more apparent; the lameness is more complete, and falling is more certain.

Treatment is conducted as for ruptured muscles; if possible with more care to prevent motion and insure apposition; and usually for a longer period. Reparation is by plastic production, which is at first redundant in volume; but, becoming more and more dense, it ultimately occupies the space to no undue extent; not constituting true tendon, but of a firm, fibrous character, very similar to ligament in appearance, and well suited to the discharge of its assumed functions.

Tendon, when cut, reunites in the same manner as after rupture. If the injury has been inflicted by accident, it is usually compound; the wound tends to inflame and suppurate; and the cure is likely to prove tedious, by granulation. When the division is by design, as for the cure of deformity, it is of the subcutaneous character; reunion is simple, and comparatively rapid.

In the latter case, it is not essential that the divided extremities should be in absolute contact; there is a power of efficient reproduction, even when a considerable space intervenes; a circumstance of much importance in modern surgery—directed to the relief of deformity.

Ununited Tendon.

A divided tendon sometimes fails to unite; leaving an unoccupied void between the separated extremities, and rendering the part almost or quite useless. To remedy this state, an incision may be made, in order to pare the retracted ends and unite them by suture. Or the process by subcutaneous puncture may be employed, as for ununited fracture. Of the two methods, the latter, on account of its comparative mildness, is greatly to be preferred, in the first instance, at all events; experience having proved it to be quite successful.

When a tendon is divided within its sheath, and even when this in-

jury is a subcutaneous one, either the extremities of the tendon do not unite, no sufficient medium being produced ; or each portion unites separately to the sheath ; and thus the function of the extremity of the tendon is lost. This fact is of importance both in prognosis and in practice ; rendering the division by tenotomy of a tendon within its sheath inexpedient ; and intimating that all attempts to produce union, should function be found to be destroyed, will prove quite nugatory.

Displacement of Tendon.

Tendon may be simply displaced, and so give rise to pain, swelling, and want of power in the limb. The tendon of the biceps flexor cubiti, for example, may be tilted out of the bicipital groove, and rest on the minor tubercle. The accident is somewhat obscure, the change of relative position being but slight. When detected, replacement is easily made.

Hypertrophy and Tumour of Tendon.

Hypertrophy.—Tendons are liable, in the elderly, to become affected by simple enlargement ; causing not merely deformity, but also pain, debility, and general loss of function in the part. The tendon most frequently observed to be thus affected is the Tendo Achillis near the heel. Treatment is by rest, discutients, counter-irritation, and relaxation of the muscle or muscles implicated. To fulfil the last indication, for instance, in the case of the Tendo Achillis, it is well to walk but little, and with the heel of the shoe somewhat raised. Often a gouty diathesis exists, and requires to be attended to in the ordinary way.

Tumour.—There seems no good reason theoretically why tumours should not commence their development from the connective tissue of tendon, as well as in other fibrous tissue. Such, however, is undoubtedly in practice a very uncommon occurrence. Mr. Syme* has narrated a case of this kind in a young female, affecting one of the tendons upon the flexor aspect of the fore-arm, and simulating a neuro-matous affection of the median nerve. On removal the tumour was found to be of a medullary nature.

* Observations in Clinical Surgery, p. 200.

CHAPTER XXVI.

BRUISE.

BRUISE of the living textures is caused by the forcible application of an obtuse body ; as when a part is struck, or violently compressed or squeezed. The effect produced consists in more or less injury done to the interior of the part, without solution of continuity in the integument. The degree of severity varies, from the slightest contusion, to instant and complete disorganization and death of the tissues. A spent cannon shot, for example, may, without breaking the skin, completely disorganize the part struck, reducing it at once to the condition of a jelly or pulp. Or, again, as happens frequently in contused wounds, the part may not be instantly deprived of life, but have its vitality so far weakened as readily to yield before subsequent inflammatory progress.

In ordinary bruise, however, there is no sloughing, either primary or secondary. The subcutaneous tissues sustain a greater or less degree of disruption ; attended by extravasation of blood, and consequent swelling. The discoloration, or *ecchymosis*, as it is called, always assumes a most prominent place among the signs of the injury ; the superficially infiltrated blood, as it undergoes absorbent change, causing a variation of hue—from the natural blood colour, somewhat intensified, to black or dark blue, thence to violet, from that to green, and afterwards to yellow. *Ecchymosis*, however, as a symptom of bruise, may be altogether absent ; either from the coexistence of a wound by which the extravasated blood escapes externally, or by the extravasation taking place only in the deeper tissues which are shut off from communication with the superficial areolar tissue by dense fasciæ. Or the *ecchymosis* may be tardy in appearing ; the collection of blood being so deeply seated that the serum of coagulation, containing the colouring matter of the clot, may be even weeks before it shews upon the surface. Pain is felt at the time of the injury ; usually of a dull, sickening kind ; but sometimes acute, when a sensitive part has been struck over resisting bone, as on the shin. After a time, the pain becomes aggravated, if any considerable degree of the inflammatory process supervene. And then, too, swelling is increased, by the attendant inflammatory product. If the process prove slight, the swelling soon begins to subside from absorption taking place ; and gradually, extravasation with its attendant *ecchy-*



Fig. 228.

Fig. 228. Bruise of the scrotum.

mosis, and the inflammatory results, disappear ; and the part is restored, almost, to its normal condition.

If an arterial branch have been ruptured, of considerable size, swelling forms rapidly ; and is distinctly fluctuating and pulsating ; consisting of escaped blood, yet in the fluid state ; and either directly receiving its impulse from the still open vasculous communication, or from the impulse of an artery of some importance with which it lies in contact. After a time, partial coagulation takes place ; the clot being arranged at the circumference of the swelling, and the fluid portion occupying the centre. It is most important that this be distinguished from acute abscess ; for it requires very different treatment. There need be no difficulty. The one is immediate, the other of secondary formation ; the abscess is necessarily preceded and attended by all the usual symptoms of the inflammatory process, the other is not. The same process of decadence takes place, as in ordinary bruise ; swelling ceases ; discoloration becomes marked and varied ; extravasation, both solid and fluid, is absorbed ; and, ultimately, the normal colour and form are both restored.

When an artery of some importance has given way, false aneurism may form, and follow the ordinary course. Or the vessel may speedily become obliterated, at the ruptured part, as in the more ordinary case just mentioned. The extravasation then gradually disappears, in the usual way.

The indications of treatment in bruise are, like those in sprain, to avert inflammatory accession, to promote absorption of extravasation and inflammatory product, and to restore function. Rest, fomentation, antiphlogistics when required ; followed by friction, support, and gradual resumption of use. When the tendency to sanguineous extravasation is great and obvious, the application of cold, or immediate and uniform pressure, may be expedient, for a time, in order to restrain the accumulation. However great the extravasation may be, even though attended with pain and tension of the integument, incision should never be practised, at least in the first instance. Many ounces of blood may be absorbed in a short time, leaving the part but little injured by the temporary malposition. But, should only the most careful puncture be made, in even slight cases, the atmospheric stimulus is almost certain to induce inflammatory excess ; profuse and unhealthy suppuration ensues ; incision is then required, in earnest, to save texture ; the system is untowardly involved ; and the cure is both tedious and unsatisfactory. Keep the skin entire ; leave the blood to Nature during the period of probable excitement ; and afterwards contribute towards absorption, by friction, pressure, or other suitable stimuli. A solution of the muriate of ammonia often proves a grateful and efficient sorbefacient, in such cases. Where, however, the swelling is rapidly increasing, where neither cold nor pressure prevent its continuance, where symptoms of internal hemorrhage begin to manifest themselves, then an incision may be made with every propriety, and the bleeding vessels secured either by ligature, or by pressure—now more accurately applied than it could have been before.

Should suppuration take place in the infiltrated part, then free and

early incision should be practised unhesitatingly ; according to general principles.

Two popular errors obtain in the treatment of sprain and bruise ; namely, the too early use of leeches and of friction. Nothing is more common than to apply leeches immediately after infliction of the injury, in order that they may suck out the extravasated, or "bruised blood," as it is called. These little animals drink only from the running stream, drawing for themselves from the blood-vessels ; and, therefore, they fail to perform what is expected of them by their employers. At the same time, their bites are likely to set up inflammatory mischief in the weakened and undermined skin, probably followed by extensive sloughing, and consequent exposure of the whole sanguineous depôt. They may be required at a later period ; to moderate inflammatory accession, occurring as a secondary result of the injury, and then should be applied, not where the skin is most discoloured, and therefore probably most weakened, but where the part is most nearly normal in appearance. Friction, in like manner, is often very improperly employed from the first. The result is, to induce and aggravate the inflammatory process—an event which it ought to be our main endeavour to avoid. Friction is expedient only after the period of excitement has passed ; and, even then, it must be at first employed gently and with caution.

By the term *Ecchymosis* is understood, discoloration produced by extravasation of blood beneath skin or mucous membrane, however induced ; usually, however, the result of a bruise, or oblique wound ; but sometimes, as in rupture of muscular fibres, unconnected with any external injury.

From its importance and constancy as a symptom of bruise, this discoloration requires to be distinguished (1) from that which is occasioned by advancing gangrene, (2) from suggilation or *post-mortem* livor, and (3) from the extravasations of purpura hemorrhagica. In gangrene, the discoloration of the tissues is at first slight, and gradually intensifies in depth of tint as the part becomes more fully mortified ; its development is therefore accompanied by diminished temperature and sensibility in the part, and with usually more or less crepitation from the presence of gas evolved in the process of putrefaction, with the formation of phlyctenæ, and easy peeling of the cuticle, as in a dead body. In bruise, the discoloration is first dark, and gradually becomes fainter and fainter ; except, indeed, where the extravasation is deep seated, and slowly makes its way towards a dependent surface long after the receipt of injury. The temperature and sensibility of the part are usually increased, there is no crepitation from air, except in rare instances where emphysema exists ; and then this is coetaneous with the injury (*e. g.*, in the eyelids, with fracture of the nasal bones and emphysema), and disappears within a few hours or days at the most. When vesicles form, they are fixed and attended by inflammatory symptoms, and the neighbouring cuticle does not peel on pressure from the cutis beneath. The discoloration of livor is easily recognised by its dependent position, and by making an incision through the textures concerned ; when the dark colour will be found due, not to extravasation of blood, but to congestion of the venous radicles and capillaries of the skin, with, in some cases, staining of the true skin

with serous fluid, containing the colouring matter of the blood in solution. In purpura, the extravasation, which, it should be recollected, may take place in very considerable quantity from but slight causes, is superficial, and accompanied with petechiæ situated at the roots of the hairs over more or less of the general surface, but more particularly in the lower extremities. Sometimes extravasations are met with which have occurred after death; these are always from large vessels, and the blood is in a fluid state.

CHAPTER XXVII.

SUSPENDED ANIMATION.

THIS may result from a variety of causes ; and according to the nature of these will the surgeon's duties vary, in his attempts at resuscitation. In the emergency, there is but little time for thought or deliberation, and it behoves the practitioner to be at all times ready, bearing about with him distinct ideas of the cause of threatened death, as well as of the most likely means to avert that calamity.

1. *By Syncope* ; from emotion, heat, bad air, or loss of blood. This has been already considered, in its nature and treatment ; the latter consisting mainly in attention to position, administering the ordinary stimuli, and, if need be, directly rousing the heart's action by epigastric friction or by galvanism, if an apparatus is at hand, or even by transfusion of blood, should hemorrhage be the cause. Recumbency, with lowering of the head, and the admission of fresh, cool air, with cold water dashed on the ears and hands, usually suffices.

2. *By Strangulation and Laryngeal obstruction.* This acts destructively to life through the trachea, veins, and brain. By injury to the first, or by its occlusion, asphyxia is produced ; by venous obstruction further cerebral congestion results, and apoplexy may ensue ; by concussion of the brain—in the case of a “drop”—more or less insensibility is at once established. And of these, the most important is the first. It is very seldom in hanging that displacement of the vertebræ takes place ; only when the drop has been unusually great and violent.

The symptoms of strangulation or laryngeal obstruction, as observed in animals, is as follows :—the lips and face become discoloured ; the muscles are convulsed ; those of respiration act more and more feebly ; in less than two minutes they cease, the heart's action still maintaining the circulation for two or three minutes longer ; and at length this, too, stops. Then death is complete, and recovery impossible.

Treatment resolves itself into simple indications. When called to see a patient, who is found in an asphyxiated condition, make sure by digital examination of the throat that no foreign body is lodged, in the pharynx, larynx, or œsophagus. In cases of attempted suicide by hanging : “ 1. If the ligature is removed before the efforts of the diaphragm have ceased, ‘all that you have to do is to watch the patient carefully ; if natural respiration continue, leave him to himself ; if it cease, supply the want by inflating the lungs artificially.’ 2. And this applies to all cases of asphyxia—If the efforts of the diaphragm have already ceased, have recourse to artificial respiration without delay. There is no time to lose. In two or three minutes, after the last heave of the chest, the heart's action will have ceased, and then all hope is over. 3. In successful

cases, so soon as normal respiration is established, inflation is desisted from. But treatment is not to cease. The patient is not safe. Dark blood has been circulating in the brain; and symptoms like those of poisoning by a narcotic may exist. Coma may remain. By and by the respiration may again cease. Then has arrived a second period, at which artificial respiration may be necessary to preserve life. And, in truth, the practitioner may expect to be called upon to inflate the lungs more frequently at this second period than at the first."* To relieve the distended and paralysed right side of the heart, jugular venesection, to admit of regurgitant bleeding, has been recommended; and certainly in the lower animals, even when the heart's action has ceased (as far as external impulse can estimate its contractile condition), it has been manifestly serviceable.

To inflate the lungs, various methods may be adopted. The trachea may be opened, for more direct access; but that is unnecessary, unless some great injury have been done to the larynx, or unless the rima glottidis be otherwise insuperably obstructed—which it is not likely to be. In an emergency, no bellows, tube, or other inflating means may be at hand. In which case, let the fore-finger of the left hand be thrust over the tongue, so as to hook up the epiglottis, and keep the rima open; or seize the top of the tongue in the fold of a towel between the fingers, or with catch-forceps, if at hand, and pull the organ tensely forwards; then with the other hand, or with the aid of an assistant, exert pressure on the chest, so as to produce alternate diminution of its space and spontaneous expansion. At the same time, inflation may be made through the nostril, if thought necessary. More recently, other methods have been devised for effecting this procedure; and careful experiments upon the dead body have been instituted, with the view of determining the amount of air admitted and expelled during each artificial inspiratory and expiratory movement. Two other of these plans deserve notice; one rendered notable as the "Marshall Hall or ready method," the other that of Dr. Sylvester. In the first, the patient is laid upon his face on a table, with the head hanging low, so as to admit of the escape of fluids from the mouth and the falling forward of the tongue; the patient is then regularly and slowly rolled from the prone to the recumbent posture, and back again to the prone position. His own weight, when prone, acting against the table, is the compressing agent by which the air is expelled from the chest; the recumbent posture being that condition in which the elasticity of the thoracic walls, now unopposed, admits of the expansion of the thorax and the inflation of the lungs. The other method, of Dr. Sylvester, consists in the alternate elevation of the arms above the head, and their adduction to the sides of the trunk. The arms, by their attachment to the chest, when elevated act as levers in expanding the thoracic cavity, and produce active inspiration; when depressed, and still more when the thoracic walls are at the same time compressed from either side, by the assistants occupied in these manipulations, expiration is forcibly effected. As both inspiration and expiration are by this method made as thorough as is mechanically practicable, it is probable that more air is admitted and expelled by it than by any of the

* British and Foreign Medical Review, No. xliii. p. 163.

others. The first and last mentioned methods, where compression of the thoracic parietes at the lower part is produced by pressure on the epigastrium and lower lateral aspect of the thorax, have probably one advantage—that a direct fillip is at the same time given to the failing action of the heart, stimulating it to increased effort, while freedom of escape is also given to the blood contained in its right cavities, by the acts of respiration. This stimulation of the heart may be more efficiently produced by means of a galvanic battery ; one pole of which is placed at the nape of the neck, the other over the epigastrium.

If an elastic tube is available, formerly it was deemed advantageous to lodge it directly in the larynx ; by passing it along the nostril down to the throat, and through it blowing in air, by bellows or by mouth, and subsequently expelling this again by pressure on the chest. Or, should no larynx tube be at hand, the nozzle of the bellows was recommended to be placed in the nostril. Or, if no bellows could be got, a tube was to be constructed out of a roll of paper, parchment, card, or any similar substance, with a like object in view. When bellows were employed, it was important to bear in mind that it was neither necessary nor advisable to shut the mouth and other nostril ; these acting as safety-valves, to prevent excessive insufflation, and injury to the lungs thereby. But where no tube passing into the larynx was employed, the box of the larynx had to be pressed against the gullet, during use of the bellows ; to prevent inflation of the stomach. For were this filled, descent of the diaphragm would be prevented, and no air could enter the lungs. Inflation thus effected had to be made gently, so as to avoid all risk or injury to the air-cells ; and at proper intervals, so as to imitate the rhythm of natural respiration. But now-a-days such mechanical appliances to attain this end are never resorted to ; the other methods being more truly “ready” for instant application in any emergency, and quite as efficient, in any instance where this restorative measure can prove availing.

The patient having rallied, after-treatment may be required. Congestion may take place ; and, to relieve this, it may be thought necessary to abstract blood. This, however, must always be done with caution ; seeing that there can be but little tolerance of the remedy, in the yet enfeebled system. The patient should be kept in an atmosphere of moderately-warm temperature, “to compensate for the insufficient generation of animal heat, which results from the impaired state of the functions of the brain, whether arising from the influence of a narcotic poison, or from another cause.”

3. *By Submersion.* In drowning, death occurs as in strangulation, by want of aëration of the blood ; consequently, in the first place, blood is circulated which is in a condition unfitted to support animal life, and then, sooner or later, its circulation through the minute vessels of the lungs is wholly arrested. To this arrest of the pulmonary circulation is due the engorgement of the right side of the heart and pulmonary arteries, so constant an effect of death by drowning. “After immersion, a deep expiration takes place, by which bubbles of air are expelled from the lungs. Then comes an ineffectual effort to inspire ; but water does not enter, in quantity, instead of air ; spasm of the muscles of the larynx seeming to prevent this. In fact the presence of water in the bronchial

tubes is not by any means constant in cases of death from drowning. The attempts to breathe are repeated several times, and after each attempt a small quantity of air is expelled from the mouth and nostrils, until the air-cells of the lungs are partially, but not completely, emptied. Then insensibility occurs, and convulsive actions of the muscles mark the instant when the brain begins to suffer from the influx of the dark-coloured blood. Soon all motion ceases; save in the thorax, where the heart may be felt yet feebly pulsating. Perhaps some further ineffectual efforts at respiration are resumed, and then all is still. The interval between cessation of respiratory effort (Asphyxia) and cessation of the heart's action (Death), is brief in the case of strangulation; but it is still more brief in drowning. And the whole series of events, in the latter case, succeeding rapidly, are complete within a very few minutes."* All alleged facts to the contrary are justly held, by competent authorities,† to be apocryphal. "The time during which professed and accomplished divers are able to remain under water, probably never exceeds two minutes; although it may *seem* to be much longer. And the exaggeration of the time of submersion, by a bystander, in the case of either drowning or diving, may very readily be imagined to take place as it were involuntarily, without any intention to deceive; the observer being himself deceived as to the lapse of moments, by the multiplicity of events which have been crowded into them."‡

Treatment of the Drowned. If the body be recovered before the diaphragm has ceased to act, breathing may be resumed naturally; if not, artificial respiration is to be employed, the mouth and fauces having been cleansed from all foreign matter. At the same time, warmth is applied by means of dry heat and friction. Venesection is not indicated; neither is the use of stimuli—unless it be the application of galvanism to the heart, in circumstances otherwise desperate.

The resuscitating means—already narrated—begun without an instant's delay, are patiently persevered in so long as any reasonable expectation of success remains. If the submersion have been complete, and prolonged beyond four or five minutes, all efforts will probably prove in vain. Still, and under even more unpromising circumstances, it is right, for very obvious reasons, not to neglect a fair and reasonable trial of the restorative means.

4. *By Carbonic Acid, or other Poisonous Gas.* Here death is not purely by asphyxia, as in strangulation and submersion. Only two destructive gases—hydrogen and nitrogen—are said to be *negative* in

* British and Foreign Medical Review, No. xliii. p. 164.

† "The cases which have been reported to the Royal Humane Society of drowned persons who have been restored to life, when taken up cold and breathless after an immersion of half an hour, shew that it is not travellers alone that are guilty of the vices of exaggeration and invention. We are compelled to regard these as mere extravagant fables, not more authentic, though certainly less poetical and elegant, than those of nymphs and mermaids, who reside in grottoes beneath the waves of the sea, or than those Arabian fictions, which have astonished our youthful imaginations with the history of submarine nations whose princes dwell in palaces of crystal at the bottom of the ocean."—SIR BENJAMIN BRODIE.

‡ British and Foreign Medical Review, No. xliii. p. 165.

their action. All the others are *positive*; exerting a distinctly poisonous effect when received into the lungs. Of these, the two most apt to act injuriously on the human frame, in this double way—partly by suffocation, partly by poisoning—are *carbonic acid*, and *sulphuretted hydrogen*; administered either suicidally or by accident. In the latter way carbonic acid may be applied noxiously, or fatally, by confinement in an unventilated apartment; by sleeping in a confined room where charcoal is burning; by immersion in the gas extricated during fermentation; by exposure to the *choke-damp* of mines, cellars, wells, etc., or to the gas extricated in calcination of chalk or limestone. Sulphuretted hydrogen produces speedy death to those who are brought in contact with it, even when largely diluted by atmospheric air; as in drains and sewers. Inspired in its pure state, it is almost instantaneously fatal. Air slightly contaminated by it produces nausea, sickness, and general discomfort; which may be followed by quick pulse, hurried breathing, and delirium.

Treatment, in suspended animation from such causes, consists in cold affusion, stimulating embrocations to the chest and extremities, and artificial respiration. For the latter indication, it is recommended to pass a tube through the glottis, which may be spasmodically closed, and failing in that, or no tube being at hand, that laryngotomy should be performed, so as to permit certain access of air to the lungs. By drawing the tongue forwards, artificial respiration will probably, in all cases, be easily effected; and until this has been at all events efficiently attempted, neither tube nor laryngotomy should be had recourse to.

5. *By Lightning*. This seems to act chiefly on the brain and nervous system; producing symptoms, in the cases which are not immediately fatal, closely resembling those of concussion of the brain. When death is instantaneous, bruise, laceration, fracture, and scorching of the body may be found.

In the slighter cases, cold affusion will assist reaction. In the more severe examples, warmth to the surface will be necessary; with recourse to artificial respiration when natural breathing begins to flag.

6. *By Cold*. In this country, death from exposure to cold is usually associated with improper food and clothing, or with intemperance. Cold, however, when great or long continued, is quite sufficient of itself to extinguish life. Like the preceding, it seems to act mainly on the nervous system; producing giddiness, dimness of sight, feebleness and rigidity of the limbs, torpor, and profound sleep; during which state of lethargy the vital functions gradually cease—all the more if alcohols have been taken during or previous to the period of exposure.

The curative indications are twofold. To restore circulation and sensibility; and yet to ensure moderation in reaction, so as to prevent the fatal effects of its excess. The body is rubbed first with snow—or cold water, if snow cannot be found—and afterwards with some dry soft substance. Then it is placed in a cool bed, in a room without a fire, while moderate friction, without any stimulant, is continued. A gently rousing enema—such as gruel, with a small quantity of turpentine—may then be administered; and, if the power of swallowing have been by this time regained, some simple nutriment, as warm milk or beef-tea, or

weak wine and water, may be given. Afterwards, support is administered very cautiously ; always with a remembrance that rapid and excessive reaction must prove almost certainly fatal.

7. *By Poisons.* The vast variety of poisonous substances, and the certainty with which many of them, if not counteracted, produce death, are known to all. The surgeon is often called upon to afford his aid in evacuating the contents of the stomach ; and that is most efficiently done by means of the stomach pump. Should this instrument not be at hand, and the patient still be conscious, emesis may be produced by tickling the fauces ; or by administering mustard, hot water, or—still better—sulphate of zinc.

CHAPTER XXVIII.

ON ANÆSTHESIA IN SURGERY.

THE employment of anæsthesia in surgery is fully established ; and, in this place, it is no longer necessary either to argue in its favour, or to trace the steps whereby it has become secure in public confidence—as a threefold agent of good :—1. Suspending sensation, and absolving the patient from pain ; 2. Suspending voluntary and involuntary motion, and so facilitating the manipulations of the surgeon ; 3. Protecting the system from the shock of operation which would else occur, and so rendering amputations practicable in circumstances otherwise hopeless. It is enough to advert briefly to the circumstances of its administration.

Chloroform and ether are the agents at present in use ; and, in this country, the former is usually preferred. It should be of great purity, and of sp. gr. 1.497.

The inhalation is managed cautiously, by an experienced hand ; and in the important operations of surgery, during which the attention of the surgeon ought to be undistracted, and solely occupied with his operative work, it is essential to have an assistant to whom the charge of the anæsthetic process can be safely and wholly committed : one who has sufficient self-control to limit his observation and attention exclusively to watching the effects of the chloroform—however interesting and attractive the surgical proceedings may happen to be.

Usually no special instrument for administration is employed ; it being found more simple and safe to use a towel, handkerchief, or such like cloth, concavely arranged, and moderately saturated with the chloroform. The cloth is held near to the mouth and nostrils, so as to insure full inhalation of the vapour, while at the same time a sufficient amount of atmospheric air has access, so as to prevent the risk of asphyxia.

Gentle, deep, regular inspirations are the best, in a passive state. And the patient is to be exempted from all noise and movement as much as possible.

No patient is proof against good chloroform well administered. Some require a much larger dose than others ; but, sooner or later, all will succumb. In those who long resist, special care is necessary to watch the effects after a considerable quantity of the anæsthetic has been consumed.

The administrator, when the patient is “over,” and the stertorous condition of breathing has been induced, has a constant eye to the countenance and chest, an attentive ear to the coming and going of the laryngeal breathing, and a frequent hand upon the pulse—the *state of the breathing* being ever uppermost in his mind. It is time for him to withdraw

the agent, or to diminish its dose—letting in more of the atmospheric air—when the pulse becomes very rapid and small, or very slow ; or when the countenance is convulsed, greatly congested, or ghastly pale, with respiration obviously imperfect. Or, without withdrawing the chloroform, the tip of the tongue is laid hold of with catch-forceps, and pulled forwards to its utmost stretch ; respiration being further facilitated, if need be, by alternating pressure on the chest. The agent first excites the functions of the nervous centres, and afterwards suspends them ; affecting the brain first and the spinal cord secondarily, so as to abolish sensation and motion for the time ; yet leaving intact the nervous functions essential to life.

In what may be termed the transition stage, the patient inclines to speak, laugh, sing, or articulate in some way, and muscular movement is considerable. The better the chloroform, the more rapid the inhalation ; and the quieter the condition of the patient, the more likely is this stage to be quickly and favourably passed.

Then succeeds the condition of insensibility and relaxation ; evidenced by steady breathing—usually more or less stertorous—fixedness of the eye, relaxation of all voluntary muscles, and insensibility to pain. This reached—as attested by the eye submitting to be touched without either winking or wincing—the operator proceeds ; and, during the operation, it is the business of the administrator to keep up this condition, by occasional reapplication of the chloroform from time to time ; never allowing the patient to emerge, even imperfectly, from the state of impassivity and stupor.

This condition must be maintained with special care in all operations which would otherwise prove very painful, necessarily imparting shock to the system ; and also in those manipulations, as in the reduction of dislocations, in which absolute relaxation of the voluntary muscles is quite essential.

It is a condition very nearly allied to impending cessation of life. A patient so anæsthetized seems, to the uninitiated, to be absolutely *in articulo mortis*. Very little more would place the circumstances in most critical relation. And two rules emerge accordingly :—1. Never to place the patient in that state, unless this be absolutely necessary, or at least highly expedient. 2. When the patient is in that state, let him be tended with the utmost solicitude and care.

If danger threaten—evidenced by imperfect breathing, collapsed countenance, unsatisfactory pulse, and the bleeding from the wound becoming more and more plainly venous in tint—the best restorative is free circulation of air around the patient, securing at the same time the certainty of its access to the lungs, by means of the forcible extension of the tongue ; widening the circle of bystanders, opening the window, fanning the face, and, if need be, acting on the chest by compression. The risk is by asphyxia, to which the cessation of the pulse and arrest of the heart's action is always secondary.

In minor operations—such as tooth-pulling, evulsion of nails, opening of abscesses, extraction of foreign bodies, etc., where absolute impassivity is not required—deep stupor is not necessary. For it is found that though the operator in his manipulations may produce muscular

movement, or cries indicative of pain, no pain is complained of, or indeed remembered, after all is over.

In emergence the patient is left to himself. But if progress is slow, this may be assisted by fanning the face, and occasionally sprinkling it with cold water.

If much chloroform has been given, especially if the patient has had food, however small the quantity, within six hours of the administration of the drug, vomiting may be expected. This is watched. The patient is turned upon his side, and care is taken that the windpipe is not filled or compressed with what is regurgitating past it.

In general, vomiting is to be avoided; and in some operations—as on the eye—its occurrence is especially untoward. The following are the best means of prevention:—pure chloroform, rapid induction, and a previously empty stomach. In a preconcerted operation, the patient should always, on this account, be fasting.

Should sickness or faintness continue to a troublesome degree, after emergence, it may be necessary to administer wine, brandy, or other stimulus—cautiously.

The best after-condition is that of sleep; of a natural and tranquil kind. The patient then should be left undisturbed.

If pain continue, of a violent kind—as after ligature of hemorrhoids—this may be greatly assuaged by a minor use of the chloroform; the patient whiffing it slightly, in a handkerchief, from time to time.

There are certain circumstances which, if they do not forbid the deep stupor of anæsthesia altogether, require the agent to be managed with the extremest caution; as in fatty disease of the heart with tendency to syncope, in tendency to congestion of the brain, in strongly marked hysteria, and in operations on the mouth with risk of asphyxia from blood accumulating in the air passages. These matters, however, with many others, will fall to be discussed each in its proper place, in connection with the operations of surgery.

Local anæsthesia—quite sufficient for many a minor operation—may be produced by the application of cold, according to the method of Mr. Arnot. Pounded ice, with half its bulk of salt, is put into a muslin bag, and held upon the part till this become pale, hard, and senseless. In emergence, the same precautions are necessary against immature secretion, as in ordinary exposure to cold.



CHAPTER XXIX.

OPERATIONS.

IT is a favourite phrase by which operations are stigmatized as the "opprobria of surgery." Nothing can be more unjust. Safely and expeditiously to remove parts which accident has rendered totally useless, and which would prove highly injurious if longer attached to the body; to take away diseased formations, or other noxious substances, and, at the expense of suffering, comparatively brief and slight, to dispel torture which had rendered existence a burden for previous weeks, months, and years; to accomplish such results, is alike creditable to the operator and beneficial to the patient. It is not the operation—but the operation unseasonably, unnecessarily, unskilfully performed—that brings disgrace; and to refrain from operating when we are plainly and peremptorily called upon to do so, would involve not only opprobrium to surgery, but guilt and shame to the surgeon. In former times, it is true, operations were the disgrace of our art. Knives, hot irons, screws, files, gimlets, gouges, hammers, and saws, were employed with cruel and ignorant recklessness. Of late years, however, every good surgeon has sought not only to simplify and diminish the number of instruments, but also to use them as seldom as possible. He does not hesitate to employ them, when his knowledge and experience intimate that they have become indispensable; on the contrary, he will then probably be urgent in their application, knowing that an early wound may save much after-suffering. But, in the first place, he will exert all his skill and all his powers, by milder measures, so to counteract injury and restrain disease, as to supersede the necessity for operating. To effect this, is doubtless the true triumph of his profession; and to this triumph he often attains. But he must be Utopian indeed who can seriously hope that the period will ever arrive, when operations shall have altogether ceased to be required. Modern surgery, accordingly, while anxious to limit the necessities for operation, is not the less aware of its importance as a means of cure; and has not only directed attention towards its improvement, but also extended its application, and with the happiest result, to diseases formerly without remedy. Many patients, for example, are now by the knife freed from morbid growths and natural deficiencies, who were formerly left the hopeless prey of deformity and disease.

A prominent cause of modern improvement in the art of operating, is an increased simplicity of the instruments, their arrangement, and use. On this subject, one who was pre-eminently distinguished among the operators of the present day, observes: * "Our armamentaria should contain simple and efficient instruments only; the springs, grooves,

* LISTON, Operative Surgery.

notches, and curves, seeming to be chiefly intended to compensate for want of tact and manual dexterity. The apparatus, though simple, ought to be in good order, and should always be placed within easy and convenient reach of the operator, so that he may be in a great measure independent of the lookers-on; who, owing to anxiety or curiosity, hurry and agitation, are apt to hand any thing but what may at the instant be required. He will consider well what place he himself may most conveniently occupy during the operation; and, having obtained proper assistants, he will make sure that they all understand what is expected of them. In short, before he ventures to begin, he will ascertain that every thing is arranged, and in proper order; more particularly, that the cutting instruments have good points, that their edges are keen, and that the joints of forceps and scissors move freely and readily.

“The skin, and in many instances the subjacent parts, should be divided at once and completely, by a single incision made lightly and rapidly—the parts being placed in a state of tension by the fingers of the surgeon or of an assistant—for the pain experienced is in proportion to the pressure and tardiness of movement in the instrument applied. Partial division of the skin, in tails left at each end of an incision, is also to be avoided; for the pain of such a cut is unnecessarily severe; and, besides, such wounds are not so available, as they would otherwise be, for the intended purpose of evacuating fluid, for permitting the extraction of foreign bodies, or for the dissection of morbid growths. Also, the pausing of a surgeon in the midst of a dissection, and the resort to fresh and more extensive incisions of the surface, is not only always awkward, but attended with additional and unnecessary pain to the patient. Every cutting instrument should be well balanced, and placed in a steady, smooth handle; the point should either be in a line with the back, which ought then to be perfectly straight, or both edge and back should be equally convex, with the point corresponding to the middle of the blade.

“The form and size of the instrument ought always to be in proportion to the extent of the proposed incisions, as regards both their length and their depth: nothing can be imagined more cruel and reprehensible for example, than an attempt to remove the lower extremity of a full grown person with a common scalpel or dissecting knife. If an extensive incision is necessary, an instrument should be employed possessing length of edge sufficient to separate the parts smoothly and quickly. Should the operator, on the contrary, be required to cut on important parts—to perform a delicate dissection of the living tissues—he will choose a short-bladed instrument, with a handle rather long and well rounded; and, after the superficial incisions have been effected, he will hold it as he would a writing pen, lightly but firmly, so that he can turn the edge, and cut either towards or from himself, as occasion may require. A small well-made scalpel, with a good point, and less convexity than those usually employed, is the instrument best adapted for such a purpose. Grooved probes and directors should be used as little as possible. With a little practice, incisions may be made upon the most delicate parts without risk, one layer being cut after the other. And if any instrument is wanted to make the proceeding more safe—if the closel

investing fasciæ of a hernial tumour, for example, are to be cautiously raised—dissecting forceps will be found the most convenient instrument for elevation previous to incision.

“In dividing the skin, the knife, whether a scalpel or a bistoury, is to be held and entered with the point and blade at right angles to the surface. It is carried with a decided movement down to the subcutaneous cellular tissue; the blade is then inclined towards the part to be divided, and by a rapid and slightly sawing motion—as little pressure being applied as possible—division is effected to the desired extent. The incision is finished by withdrawing the knife in a position perpendicular to the surface, so as to divide the entire thickness of the skin at the extremity as well as at the origin of the wound. For dexterously effecting such manipulations, the fingers must be educated; and diligent practice in the dissecting-room will be found the best foundation for surgical dexterity, as it is for sound surgical knowledge; it is only when we have acquired dexterity on the dead subject that we can be justified in interfering with the living.” By practice, the pupil will be enabled to use either hand almost equally well; and none should neglect to attain this power—for an ambidextrous surgeon possesses great advantages as an operator.

While an ordinary degree of expertness is within the reach of any one, who will industriously seek for and improve the opportunities for its acquirement, yet a certain combination of natural qualifications is undoubtedly necessary to the attainment of pre-eminence in operative surgery; a great operator in one respect resembling a great poet,—“*nascitur, non fit.*” The importance of these natural gifts did not escape Celsus. “He must be young, or at most but middle-aged,” says he, “and have a strong steady hand, never subject to tremble. He must be ambidextrous, and of a quick, clear sight. He must be bold, and so far void of pity that he may have in view only the cure of him whom he has taken in hand, and not, in compassion to cries, either make more haste than the case requires, or cut less than is necessary, but do all as if he were not moved by the shrieks of his patient.” The coolness and courage thus inculcated are among the most valuable natural gifts of the surgeon; and it would be well, too, did every patient remember that they are equally important in himself, for on *his* steadiness and patience under suffering much of the celerity and success of an operation may sometimes depend.

In the present day, however, the operator is much less dependent on his patient than he was wont to be; in the great majority of cases the latter being absolutely passive in his hands, because quietly recumbent under the influence of complete anæsthesia. The obtaining of such quietude and non-resistance, the abolition of pain, the mitigation of shock, and various other advantages affecting both operator and patient, from the judicious use of chloroform, have been already fully considered; and on that subject it is not necessary again to enlarge.

The necessity for an operation, in any case, having been clearly established, our object is to perform it as safely and expeditiously as possible. The mere absence of protracted pain confers a most important advantage on the reparative powers of the system; and, so far, celerity

is commendable, when chloroform is not employed. But it is a very common as well as dangerous error, to suppose that excellence is always commensurate with the rapidity of performance. In the great majority of cases, haste is incompatible with safety ; while the latter is the paramount object in view. "*Tuto et celeriter*" is the operator's motto ; but the "*tuto*" precedes its accompaniment. And now, more than ever, haste and hurry are altogether inexcusable. The student, as an operator, should learn to be rapid ; but rapid, because skilful ; and rapid only when safe. And, in some procedures, he will not fail to learn that attempted rapidity must ever prove injurious—an indication not of skill but of folly.

Perhaps a more common, and still more serious error is—the imagining that operations constitute the greater and more important part of Practical Surgery. The student is very apt to be led away by the more garish and imposing parts of his profession, to the neglect of that which is in truth by much the more valuable ; and he may also forget that, in after life, he will be only occasionally called upon to perform the greater operations, while daily he must exert his general knowledge and skill, as well as his minor handicraft, to avert the necessity for the knife's employment. In the case of a diseased joint, for example, he is not at once to contemplate amputation or resection. Such procedure is the ultimatum, not the initiative, of his art. Local depletion, rest, counter-irritation, duly timed and conducted, pressure, splints, attention to the general health, these—to some apparently a simpler, but in truth a far higher, adaptation of knowledge—conspire, and often with success, not to mutilate the frame and endanger life, but to save both life and limb, at little or no cost of either pain or danger. Again, in the torturing complaint of stone in the bladder, it is doubtless a great matter to be able, by a speedy operation—severe, and perilous to life though it be—to free the patient from his misery. And the accomplished surgeon must be at all times competent to undertake fearlessly this hazardous work. But it is surely a higher exercise of a better skill, and both the means and the result will prove infinitely more creditable and satisfactory, if, by the internal use of simple remedies, and suitable attention to hygiene, the disease shall be in its very origin frustrated, pain and danger dispelled and health and comfort restored—all without the infliction of a scratch or the loss of one drop of blood. In the case of injury, too, the paramount importance of general treatment will be found equally to obtain. The surgeon is ready, at a moment's warning, to amputate skilfully a crushed limb, which has obviously no chance of retaining its vitality, and which, if not speedily removed, must inevitably peril the whole frame's existence ; and when, by such severe operation, he succeeds in averting the greater calamity, he has most just ground for self-gratulation, and may truly say that a good thing has been done by his art for suffering humanity. But when, in the case of an injury a shade less severe, there is a doubt whether or not the limb may be enabled to resist the threatened gangrene ; when he hesitates not to give to his patient the benefit of that doubt ; when, by great patience, care, and skill, he arranges the mangled fragments in their proper place, retains them so by suitable apparatus, affording due support, and yet permitting no undue pressure

regulating the play of the general circulation, controlling the efforts of the *vis vitæ*—in short, averting both local and general disaster, and bringing the healthful work of repair to complete, though it may be slowly, its valued process of cure ; and when ultimately a thorough and permanent success crowns such patient and anxious labours—surely the cause for self-gratulation is increased a hundred-fold ; the surgeon may well say that a far better thing has been done by his art ; and the discerning public should not fail to award a higher and truer meed of praise.

The advance of surgery will ever be found characterised by a corresponding decrease of its operations, both in amount and in severity. The true object of our mission is not to cut, but to cure.

CHAPTER XXX.

INJURIES OF THE SCALP.

Bruise of the Scalp.

THE scalp is especially liable to severity of contusion. It is a part much exposed to external injury; it is stretched over dense resisting bone; it is possessed of very considerable vascularity; and its arterial branches, being neither inactive nor minute, are apt to part with blood freely when torn. Hence, when external violence is applied, the higher results of contusion are very apt to follow. The integument may give way; causing a contused wound, of greater or less extent, whose margins will slough and separate, and which will not heal without considerable suppuration, and a corresponding amount of attendant inflammatory change. Or the skin, at first unbroken, may slough to a greater or less extent; either immediately, from the direct effect of violent contusion; or secondarily, by the inflammatory process induced in a part whose vitality had been only lowered by the bruise, not annihilated. Or, the integuments remaining entire, blood is copiously extravasated from ruptured vessels; breaking up the areolar tissue, and producing a large fluctuating tumour—sometimes forming rapidly, with tension of the skin, and much pain in the part. Or, subsequently to sanguineous infiltration, the inflammatory process may be lighted up in the implicated texture; inducing suppuration of an unfavourable kind, with a considerable amount of constitutional disturbance, and with a risk of the latter being unfavourably affected by the suppuration assuming the asthenic, diffuse, and infiltrating character. The danger of such occurrences must be remembered in the prognosis.

But the ordinary result of bruise, in this locality, is the formation of a bloody tumour; blood escaping more or less freely from torn vessels and accumulating in the part; while room is made for its reception partly by disruption of texture, partly by that which remains entire being pushed aside and condensed. As already stated, the integument is tense or not, according to the rapidity and amount of extravasation. At first, the indications by touch are uniform throughout the whole swelling, all the blood being as yet fluid; and uniform fluctuation is more or less distinct, with elasticity. Soon, however, the blood in part assumes the solid form; and then the characters of the tumour change. At the circumference, there is a hard, resisting ring, more or less elevated composed of coagulum. In the centre, the part is soft, yielding, fluctuating; the extravasation there remaining fluid, consisting chiefly of serum, and situated immediately beneath the integument. The clot occupies the margins. At this period, care is required in examination

lest a false diagnosis be arrived at. The finger, placed firmly on the centre, readily displaces the serous fluid, and may seem to penetrate to some depth; while similar pressure, made at the margins, meets with hard, unyielding resistance—and that at a considerably higher level than had just been passed by the finger in pursuit of the retreating serum. The careless observer of such things is apt to imagine them undoubted indications of fracture, with depression, having occurred in the cranium; supposing the hard ring to be the bone in its normal position, with an abrupt broken margin, beneath which a detached portion has been driven down. Attention to three or four circumstances, however, will suffice to undeceive. The symptoms of depressed cranium do not exist. Press firmly on the soft and yielding centre; the subjacent bone will be reached, occupying its normal level. The hard rim of the swelling will be found on a higher level than the general calvarium; and, besides, by a little firmness of manipulation, if such be deemed necessary, the clot can be displaced somewhat, leaving firm bone beneath. While in fracture with depression, the firmer we press upon the hard rim the more distinct will the outline of the fractured margin become.

The treatment of such a bruise is conducted on the principles generally applicable to this description of injury. In certain situations—as directly over known branches of the temporal or occipital arteries—swelling may be in a great measure prevented by moderate pressure being steadily maintained on the cardiac aspect of the implicated vessel; and this indication may be further fulfilled, by continuous application of cold to the part, and its immediate vicinity. When extravasation has taken place in quantity, and both tension and arterial pulsation are present, there is no necessity at this early period for any interference in the way of opening the sac or ligaturing the vessels. As formerly stated, such meddling would certainly be followed by suppuration. By the continued use of cold and pressure, the progress of the extravasation will speedily be checked; and if inflammatory access is prevented, absorption will by degrees remove every trace of the swelling. The fluid portion of the extravasation is taken up first; the coagulum follows, more tardily.

But if an acute inflammatory process shall have occurred, and suppuration formed, free and direct incision must not be withheld. By no other means can diffuse suppuration be prevented, and constitutional disorder checked. At once lay the part freely open; turn out the coagulum, and permit all fluids to escape. Should bleeding occur, then compression must be employed to check it; or if the injured vessels admit of being readily seized, ligatures may be employed to secure the bleeding orifices. An unhealthy abscess remains for a time, but duly changes, contracts, and heals; and the knife is not again required. But, delay incision; and then the knife is called for, not merely in the bruised part, but in the parts adjacent, where the matter is burrowing beneath the expansion of the occipito-frontalis, giving rise to symptoms both local and constitutional, closely allied to those of phlegmonous erysipelas, and demanding a like activity in local treatment.

Constitutional management is not to be neglected. It is obviously of great importance to avert, or at least to moderate, the accession of an

inflammatory process in the injured part. On this ground alone, rest and quietude, antiphlogistic regimen, and perhaps depletion, are expedient. But the necessity for recourse to such precautions becomes still more apparent, when it is remembered that the brain, in all cases of severe bruise of the scalp, must have suffered more or less by concussion, and has to be protected from the consequences.

When all risk of inflammatory accession has passed, and swelling has not yet disappeared, absorption may be hastened by discutient measures. The part may be kept wet with a solution of the muriate of ammonia, or with a weak dilution in water of the tincture of arnica; afterwards friction may be used, and, if need be, blistering with pressure. But in some cases, after months and even years, a hard swelling remains occupying the site of the original injury, and is apparently due to thickening of the pericranium.

Bloody tumours, of the foregoing nature, not unfrequently form on the presenting parts of the heads of children, newly born; especially if the labour have been tedious, or the pains very violent. This affection is designated by obstetricians *Cephalhæmatoma*; while simple bloody infiltration of the presenting part of the scalp is termed the *caput succedaneum*. In the commonest form of *Cephalhæmatoma*, the subpericranial, the tumour becomes surrounded at the base by an osseous ring, and the pericranium, too, is sometimes the seat of osseous formation, so as to be felt crackling over the contained blood. This blood disappearing, the ossified pericranium approaches the bone, and unites with its rough and bare surface, causing slight thickening of the bone at that part. The possibility of such morbid changes must be borne in mind, in making medico-legal examinations of bodies of children which, from their size, have probably been still-born, and which, before examination, have undergone partial or complete mummification—lest the bloody crust on the cranium should lead to the supposition that violence had been inflicted.

Wounds of the Scalp.

Simple incised wounds of the scalp are apt to prove troublesome by bleeding. The arterial point or points may be exposed, and secured by ligature. But this is one of the situations in which pressure by means of pads of lint, retained *in situ* over the bleeding point, by means of a few turns of a bandage, may advantageously be substituted for the use of the ligature. The firm surface of the cranium against which the pressure is effected, the difficulty, nay, oftentimes the impossibility, of securing the vessels by ligature, the approximation of the edges of the wound which the judicious application of pads of lint usually enables us to effect, thus preventing the necessity for sutures, will explain satisfactorily this preference of pressure. When the bleeding, however, has spontaneously ceased, and the wound gapes, or in any circumstances where stitches seem desirable, experience shews that the use of silver wire as a suture is free from the objection formerly urged against their use in the dense textures of the scalp, as liable to prove the exciting cause of erysipelas. The subsequent management is such as is ordinarily adopted for securing adhesion. One simple precaution should never be omitted

at the commencement of the treatment ; namely, the shaving of the scalp, not only at the wounded part, but to some distance around. The dressings which may afterwards be required, should union by the first intention not occur, are then more readily and securely applied ; the part is more certainly kept free from irritation ; coolness and cleanliness are more easily maintained ; and inspection of the wound's progress is more complete.

In *contused and lacerated wounds*, there is superadded to the mere solution of continuity the same risk of unfavourable inflammatory change as in bruise ; and this is, accordingly, to be guarded against. Very often, the wound is extensive, and irregular in form ; a portion of the scalp is detached from the subjacent bone, and hangs over, an unseemly flap. We have even seen the scalp torn into ragged fragments, rather resem-



Fig. 229.



Fig. 230.

bling ribbons than flaps, and exposing a bleeding and begrimed pericranium. On the other hand, it is not uncommon to see wounds of the scalp inflicted by such a blunt object as a bludgeon or poker, or the toe of a boot, or the handle of a draw-well, lift, or crane, present all the appearances of a cleanly incised wound, and sometimes heal as readily. For-

Fig. 229. The *Couvre-chef* ; a handkerchief so arranged as to cover the head, with a view to retain dressing. The handkerchief having been folded into a triangular shape, the centre of the base is placed on the centre of the forehead, the body of the handkerchief covering the head, and the apex or corner hanging down the neck. The two long ends, previously lying on the cheeks, are crossed beneath the occiput, covering "the apex or corner," and are brought forward and tied on the forehead. The handkerchief is then smoothed by pulling the "apex or corner," which is turned over the crossed "ends," and secured.—*After Lonsdale. Lancet, No. 1417, p. 470.*

Fig. 230. A double-headed roller, applied so as to cover the head ; making equable pressure on every point. The centre of the roller is placed low down on the forehead, and the two heads are carried back and made to cross low down beneath the occiput. One head is then brought over the vertex, while the other is carried horizontally round to lap its extremity ; and this, turned up over the horizontal one, is carried back to the occiput, slightly overlapping the former vertical band. At the occiput, the heads are again crossed (the surgeon shifting hands), and a third turn is made on the other side of the vertical band, while a third horizontal round secures it as before. And this is continued until the whole head has been uniformly invested.—*After Lonsdale.*

merly, it was the custom to cut away any pendulous portion ; it being considered incapable of re-attachment. Now, it is invariably preserved and both surfaces having been carefully cleansed, the flap, shaved, or with the hair closely clipped off, is replaced ; plasters, compresses, or sutures, as may seem most suitable, being employed to retain it *in situ*. It seldom sloughs, even in part. Equally seldom, however, will it unite at once by adhesion. It suppurates, granulates, and becomes slowly, yet firmly and satisfactorily, rejoined to the subjacent parts. When a congested and flabby state of the flap occurs, as often happens, during the suppuration, support by carefully applied bandaging is highly expedient. Cases have frequently been seen in which large portions of the scalp have been removed ; and, in one case of which we are cognizant, avulsion of the entire hairy scalp and neighbouring integument occurred. Such cases afford good opportunity for observing the comparative part played by contraction and reparative granulation in the formation of a cicatrix as the fixed osseous surface beneath, and the displacement of the integument in the ears and eyelids, afford definite indications of the change effected.

For retaining dressings, and affording gentle support to the scalp, common handkerchief may be applied, as in Fig. 229.

But when direct, accurate, and considerable pressure is required, the double-headed roller is preferable, as in Fig. 230.

For retaining dressings, on any particular part of the head, the four-tailed bandage is often very useful, as in Fig. 231.

But in ordinary circumstances a common net, such as forms a part of the female head-gear presently in fashion, will be found admirably adapted for retaining any dressing in its place ; while it avoids the heating of the head, which the more formal dressings certainly tend to produce.

Not unfrequently, the bone is rudely denuded of all its soft investments ; as in heavy falls, when the head comes



Fig. 231.

violently in contact with stone. The pericranium is rubbed off, and the bone is not wholly exposed, but roughened in its texture. In such cases, we are not to refrain from re-adjusting the soft parts, in the belief that exfoliation must necessarily ensue, and that an open condition of the wound is consequently to be desired. Many bones thus circumstanced recover entirely. They may, for a considerable time, become white and dry, showing only their mere surface, as if undergoing necrosis there ; yet it is by no means unusual—when such necrosis is not favoured by the treatment

employed—to find this dry bone revive, becoming vascular, brown, and exhalent, as before, and in due time contributing its quota to the general repair.

Fig. 231. The four-tailed bandage ; of use in retaining dressings on any particular part of the head. A piece of cloth split at either end : the central unsplit portion placed on the dressing. The two posterior ends secured below the chin ; the two anterior ends, overlapping these, cross at the occiput, and are also secured below the chin.—*After Lonsdale.*

process of reparation. Should the inflammatory process supervene, and advance to suppuration, either in the limited or in the diffuse form, early incision is demanded ; in the one case, to evacuate pus, and prevent accumulation ; in the other, to limit its formation and prevent infiltration. When the areolar tissue beneath the occipito frontalis' expansion is implicated in the latter event, incision is required to be especially early and free ; not only to avert destruction to texture, but also to prevent, or moderate, implication of the all-important cranial contents. These, indeed, must be duly regarded, throughout the whole period of treatment, as in simple contusion.

Punctured wounds of the scalp, usually oblique and penetrating, are always important ; being very apt to be followed by severe inflammatory mischief ; and at an early period, and on this account, demanding incision. In such cases the matter collects and tends to extend its limits in a dependent direction—its presence usually indicated by a tumid state of the integument, suffused with a reddish blush ; and a probe introduced through the wound will always find its way to the part so affected. Here it is, then, that a counter-opening should be made.

As a general rule, it may be stated that the inflammatory process in the scalp must always be treated with great activity. First, because the textures are unfavourable for safe advancement of the process ; they are vascular, tense, unyielding, fibrous ; the affection is apt to be acute ; the inflammatory product is copious and rapidly formed ; the accommodation afforded by the textures is insufficient ; tension ensues, and, as usual, aggravation follows thereon ; suppuration is speedy, and apt to be diffuse ; and the pus tends to burrow rapidly, and in all respects destructively, beneath the fibrous structures. Secondly, the part affected is in close and dangerous proximity to the cranial contents ; and these are apt to be involved in a secondary, but not less important disease.

Wounds of the Temporal Artery.

Arteriotomy.—Under rare circumstances it is deemed advisable to abstract blood, with a remedial object in view, from an artery. The temporal artery is the only one so situated as to render it suitable for this operation ; and, although the main trunk may readily enough be opened, the anterior branch is usually selected. Being quite subcutaneous, it is of easy access ; and, being also placed immediately over resisting bone, it is favourably situated for hemostatic purposes. A suitable part of the vessel having been fixed upon (and where it just begins to be covered by the hairy scalp is usually most convenient), it is steadied by the fingers of the left hand, while a lancet, moved by those of the right, is made to perforate, but not to divide, the arterial tube, in an obliquely transverse direction. The entrance



Fig. 232.

Fig. 232. Compress applied to the temporal artery, after arteriotomy.

and exit of the lancet are managed so as to make the wound of the integument considerably larger than that in the arterial coats; in order that there may be no obstruction to the free escape of blood. A section of the wound, in fact, should resemble that of a cone; the truncated apex corresponding to the aperture in the vessel, the base to that in the integument. Some surgeons recommend that a preliminary incision of the integuments should be made, and that the vessel should be opened by a second movement of the lancet; but if the manœuvre is dexterously executed there is no necessity for any such refinement. When a sufficiency of blood has flowed, it is well to reintroduce the lancet and to move its point so as to effect complete section of the vessel; in order that contraction and retraction of each orifice may take place, and natural hemostatics may so be favoured. A graduated compress is then accurately applied over the wound, and retained by a bandage. The dressing should not be disturbed for several days, unless, indeed, symptoms of the inflammatory process make their appearance, indicating that suppuration has occurred.

If blood do not escape readily enough, a cupping glass should be applied; care being taken to raise the rim gently over the artery on its cardiac aspect, otherwise the pressure must inevitably arrest the flow. And this is the only mode of cupping which can be considered warrantable in this situation. Use of the ordinary scarificator here leaves a very unseemly scar, especially in the female. The lancet's puncture in arteriotomy is, on the contrary, slight, and its scar scarcely appreciable; and, at the same time, it is to be remembered, that from this one puncture blood will flow much more freely, than from all the twelve incisions of the ordinary instrument, if only skin-deep.

In accidental wounds of the trunk of the temporal artery, deligation is generally preferable to pressure; and here both the distal and the proximal extremity should be tied, otherwise recurrence of hemorrhage is almost certain. In the case of a mere branch, it may be sufficient to tie the cardiac orifice—should this even seem necessary; pressure being, as we have already said, preferable under most circumstances.

Unpleasant consequences sometimes follow wounds of the temporal artery, whether accidental or intended; but except in cases where the main trunk of this vessel has been opened, these are of quite exceptional occurrence. *False aneurism* may form. This, usually, has attained but a small size, ere the patient's attention is arrested by it, and the surgeon's aid sought. In the majority of cases, it is sufficient to put under force the ordinary treatment for recent false aneurism; to cut through the tumour, turn out the clot, and secure the vessel by ligature above and below the wounded point. In those cases to which such procedure may seem inapplicable, removal of the small swelling, by two elliptical incisions, may be had recourse to; securing each of the bleeding points in the ordinary way, and bringing the wound together for adhesion.

On removing the compress, after arteriotomy, the wound may be found to have degenerated into an *ulcer*. The ulceration spreads, the vessel is reopened, hemorrhage recurs; and, by repetition, the loss of blood becomes hazardous. Pressure, reapplied, may temporarily arrest the flow; but necessarily favours the advance of ulceration, and

renders return of the bleeding certain, on removal or change of the dressing. It is better to abstain from pressure ; and to tie the artery on each aspect of the sore ; either by regular dissection in the line of the vessel ; or, when swelling and condensation of texture render that difficult, by transverse wounds—securing the bleeding points by forceps in the ordinary way. Sometimes, however, this would be impossible without an extended dissection ; in such circumstances a curved needle carrying a wire suture may be passed under the vessel above and below the bleeding point, and upon tying the wire the hemorrhage will be found to be satisfactorily commanded. Or, more simply, a straight needle and twisted suture may be employed. Or, again, if the ulcer be minute, excision of the changed part may be effected, as for false aneurism. Fortunately, however, such occurrences are rare, since the operation of arteriotomy has been restricted to the branches instead of the trunk of the temporal artery.

CHAPTER XXXI.

INJURIES OF THE CRANIUM ; AND THEIR CONSEQUENCES.

By external violence the cranium may be shaken, fissured, or fractured with comminution. In any case, more or less injury is at the same time sustained by the cranial contents. The brain and its investing membranes may be bruised or torn, and blood may become extravasated. The inflammatory process may be kindled ; perilling life by the accumulation of serous or fibrinous product, by suppuration, or by chronic change of structure. Or the brain may be merely shaken, and temporarily impaired in its function.

Concussion of the Brain.

In strict acceptation, this term denotes a mere shaking or succussion of the organ ; often without any appreciable lesion of structure ; but in severe cases always accompanied with more or less bruising, rupture, or laceration of the brain and its membranes, with consequent escape of blood—occurring either at the time of the accident, or afterwards when reaction sets in. Function is impaired, often most seriously ; usually is after a time restored, more or less completely ; yet not without much risk of an inflammatory process intervening, in either the brain or its membranes, to modify, protract, or prevent the fortunate issue. The symptoms of concussion vary with the degree of injury which has been inflicted. Where no bruising, rupture, or laceration of the brain's substance, blood-vessels, or membranes has occurred, the symptoms are slightly developed, and pass off in a few minutes, or at most within half an hour ; but where laceration has ensued, the symptoms may either last for hours, and terminate in a partial or very slow restoration to health, or death may ensue very speedily after the accident, and without any sign of recovery having manifested itself.

The force may be applied either directly or indirectly ; the cranium may be the part struck ; or the patient, alighting on his feet, nates, or chin, may have the force of the shock conveyed indirectly to the head through the spinal column in the first instances, and the inferior maxilla in the last, so as to act upon the base of the skull with quite as great force as though it had been directly subjected to the injury.

*The symptoms of concussion of the brain, varying in intensity according to the degree of injury, and in their nature according to the parts affected, and the period which has intervened since its infliction, are generally as follows :—*Sensation, mental power, and voluntary motion

more or less disturbed ; and a depressing effect is exerted on the general circulation. The patient, stunned, and more or less insensible, lies motionless, pale, and cold. Insensibility, however, after a time, is found not to be complete except in extreme cases ; by loud calling, monosyllabic acknowledgment may be obtained ; by pinching the skin, or otherwise causing pain, some evidence is usually given of pain being felt, and an attempt is made by the patient to move the part from the supposed source of injury. Power of motion is depressed and latent, not necessarily destroyed ; and the voluntary muscles, though relaxed, are not necessarily paralyzed. Respiration is feeble, slow, and sighing. The pulse is rapid, small, and fluttering ; and especially weak at the extremities. The pupils are usually contracted, and insensible to light ; but their state is variable ; sometimes one is contracted, while the other is either natural or dilated. Squinting is not uncommon. Vomiting is often present, and serves to indicate that reaction from this state of depression is about to commence.

The patient becomes more easily aroused ; and responds more distinctly to interrogation, either by words or by gesture. Respiration becomes more full and composed. The pulse is less frequent, and more distinct ; but, at this time, the circulation is peculiarly irritable, the mere effort of change of posture usually inducing marked increase in the frequency of the heart's action—or even syncope. Pain now is more felt by the patient ; and is referred to the head. Vomiting may continue. The returning mental power is apt to prove errant and deceptive.

Not unfrequently, a state resembling somnambulism continues for some hours during the transition to recovery. Motion, sensation, some of the special senses, and much of mental power, seem to be restored, yet the patient remains as if in a deep sleep. He may rise to evacuate his bladder or bowels, or even wash, shave, dress, perambulate ; all the while unconscious, or at least afterwards oblivious, of what occurred during this period.

But reaction seldom stops at mere restoration of the normal state ; the boundary of health is crossed, in an opposite direction. Reaction proves excessive ; and symptoms are evinced of an inflammatory process begun in the injured part—the brain, its membranes, or both. The pulse becomes full and hard ; the skin hot and dry ; the face flushed ; the eyes bloodshot ; the pupils more contracted and insensible to light. Pain, as if a cord had been tightly tied round the temples, is complained of in the head ; restlessness is more and more marked ; the mind, which may have in great measure recovered, again loses its healthful balance ; delirium supervenes, accompanied sometimes with excessive restlessness, spasmodic muscular twitchings, or even partial paralysis ; and so the symptoms advance. Resolution may occur. Or fluid inflammatory products accumulate ; the symptoms of compression are induced ; and the issue may be fatal.

Practically, the symptoms of concussion may be divided into three stages. 1. Depression ; marked by insensibility, and feeble circulation. This may be intense and enduring ; proving fatal and that speedily—the patient quite unconscious throughout. 2. Reaction. The symptoms of depression pass off ; circulation is restored ; and cerebral function re-

turns. In the slighter examples of injury, there may be no further progress made untowardly. Reaction does not prove excessive. The head is confused and giddy for a day or two ; but the pulse remains quiet ; and, within a few days more, all has passed off in safety. 3. Excessive reaction. The inflammatory symptoms set in, and a state opposite to that of depression is established ; all is excitement and perversion, both in the general circulation, and in the functions of the brain ; and life is brought into imminent jeopardy, by phrenitis, or menengitis, and by proportionate inflammatory fever. Such immediate inflammatory consequences may be certainly anticipated in all cases where laceration of the brain substance has occurred.

Treatment.—This necessarily varies according to the severity of the injury, and the intensity of its results ; but more especially is it different according to the stage and progress of the case. A man stunned by a blow or fall, and labouring under concussion, is often bled on the instant—on an attempt, at least, is made to bleed him—by the rash and thoughtless practitioner. In other words, a fresh and powerful agent of depression is exerted on the general circulation, when such depression is already great and has probably brought life to the very verge of extinction. If blood flow from the wound in venesection, under such circumstances, perhaps life is lost ; at all events, the direct untoward result of the injury is aggravated and the case is rendered both more urgent and more protracted than otherwise would have been. The lancet is certainly not to be used during this stage. In many cases we should be little more than passive spectators. The depression is not extreme, nor giving indications of long continuance ; signs of reaction, on the contrary, are slowly manifesting themselves ; and we await the natural progress of events. No altogether idle, however. Although not engaged in active treatment, we are prepared for activity, when circumstances shall call for our interference. The patient is stripped and put to bed. His whole body is carefully examined. He cannot tell us whether or not other parts have been injured. Besides an anxious investigation as to the existence or not of internal injuries, we must carefully examine each joint and bone ; detecting fracture or dislocation, and having it immediately rectified, when circumstances are all so peculiarly favourable for the required manipulations. On recovering his senses, he has not to complain of a painful and distorted limb, now for the first time observed ; but finds what was distorted duly replaced, and already some way advanced in the process of repair. The head is carefully shaved, should that be deemed necessary and is placed on pillows, considerably elevated. If wound of the scalp exist, hemorrhage, if need be, is arrested ; and approximation is effected in the ordinary way.

Should the depression prove great and continued, plainly indicating risk to life by syncope, something more is required of the practitioner. He endeavours gently to originate reaction. Warmth is applied to the surface ; and friction is used over the chest and abdomen. If this is not sufficient to turn the course of the symptoms, a stimulant enema of turpentine is given. If still the progress be downwards, an attempt is made to convey to the stomach some warm tea, or soup, or wine and water ; and stimulants are held to the nostrils, for insufflation. The

last, however, are always to be warily managed, so as to avoid risk of injury by their too free application to a patient at the time insensible of pain ; and the giving of fluids by the mouth, too, must be effected with care, lest they pass into the air passages, and produce asphyxia. So soon as reaction has begun, we cease from our auxiliary effort ; and again become passive onlookers ; completion of the second stage being always safest in the hands of Nature.

If stimulants are used at all internally, it must be only in urgent circumstances, and with much caution ; begun with a sparing hand, and repeated warily. And, in general, we are well content to do nothing, in this way ; knowing that moderate depression is a favourable occurrence ; and that premature cessation of it, especially when followed by abrupt and marked reaction, is apt to prove most injurious. For, at first, we can never be certain that the case is one of mere disturbance of the functions of the organ. There may be a lesion, by laceration of the brain's substance. During the existence of the first stage of concussion, the case remains—practically—one of mere cerebral disturbance ; circulation is weak in the torn part, as elsewhere ; extravasation of blood does not take place from the open vessels ; valuable opportunity is afforded for their closure by natural hemostatics ; and when at last—it may be after a considerable number of hours—the natural reaction slowly sets in, and circulation is proportionately restored, still no escape of blood occurs ; and the symptoms may remain without further complication to the last. Whereas, had the period of depression been abridged, and reaction rendered not only premature, but also abrupt and active, circulation would have been restored in the injured part ere the open vessels had closed, blood would have been extravasated, and compression of the brain must have ensued. Or, even if no lesion of the brain have occurred, the case being in all respects one of mere succussion of the cranial contents, still premature and excessive reaction is most hazardous ; by tending not only to kindle an inflammatory process in the brain or its membranes, but also to render it aggravated and perhaps uncontrollable in character.

Thus, then, it is plain that two great errors may be committed in the treatment of the first stage of concussion. Blood may be drawn prematurely ; lowering the vital powers still further ; unnecessarily, untowardly, perhaps fatally. Or stimuli may be imprudently employed ; too soon, and too freely ; hurrying on reaction ; and endangering life, either by compression in consequence of extravasation of blood, or by an inflammatory process of an urgent and untoward character. Let both errors be studiously avoided ; for each is of a most grave nature. While we take care that the depression does not proceed too far, let us beware of doing anything to effect either a premature or an excessive reaction. And when we attempt to fulfil the former indication, let us beware both of inducing asphyxia, by the misconducting of ingesta ; and of causing troublesome excoriation and subsequent inflammatory mischief in susceptible and important parts, by the too free or too long continued application of irritant stimuli to them.

In the second stage, while reaction is in progress, we have either hand ready—to favour, or to repress—yet very often find it prudent to abstain from active interference ; leaving the task, almost entirely,

in the more skilful and competent hands of Nature. We content ourselves with carefully excluding all source of excitement, either to the general circulation, or to the brain's function—more especially light and noise ; and cold is continuously applied to the shaven scalp, by wetted cloths, or by evaporating lotions. The head should at the same time be kept elevated. Such treatment is not calculated either to thwart or to prevent the normal amount and form of reaction ; while, at the same time, it leans to the side of repression sufficiently, to guard against the excess of reaction which not improbably is speedily to threaten.

It may happen that though the reactive effort is well begun, it ceases, flags, and retrogrades ; a period of depression again sets in ; and this relapse looks more formidable than did the first effect of the injury. Under such circumstances we are no longer inactive spectators ; but commence a cautious system of stimulation, as formerly explained. If, on the other hand—as more frequently happens—reaction threatens to prove excessive, we interpose our repressing agency. We empty the bowels by the exhibition of an aperient enema ; and aid this, by the more leisurely working of an internal purge. Seclusion from light and noise, elevation of the head, and continuous application of cold, are most carefully maintained. And if still the action is sthenic and in excess, we prepare to obtain a sedative result by blood-letting.

In the third stage, when reaction is plainly in excess, and inflammatory symptoms are fast developing themselves, the treatment is decidedly and actively antiphlogistic. Quietude and seclusion are more strictly enforced than ever ; it being all-important to obtain *rest* of the organ affected, as completely as circumstances will permit. Blood is taken from both the system and the part ; by venesection or arteriotomy, and by leeching. And such depletion is repeated as oft and as freely as circumstances seem to demand.* Purgatives are actively administered ; and it is well to remember that in inflammatory affections of the cranial contents, especially powerful doses are required. Antimony, or aconite may be given. But when the substance of the brain is plainly indicated as the site of the crescent inflammatory process, we do not hesitate to place the system rapidly under the influence of mercury ; having full warrant for this in the delicacy of structure and importance of function which are involved. Calomel is given in small doses, frequently repeated ; and usually, it is neither necessary nor expedient to combine it with opium. Not necessary—for there is a sluggishness of action in the intestinal canal, engendered by the disease, and consequently but little risk of the mineral proving purgative ; and not expedient—lest we endanger the production of narcotism, and consequent determination of blood to the part affected.

Sometimes delirium, with convulsive movements, continues after full bleeding, and is aggravated by its further repetition ; the pulse and other characteristics of nervous reaction being present. Such symptoms coming on soon after the injury, indicate that laceration of the base of

* It is rare, however, now-a-days, to meet with a case of injury of the head admitting of such free abstraction of blood as used to be had recourse to in former times, where day after day, even for a week together, venesection to the full extent was practised with apparent benefit.

the brain has occurred ; and in such circumstances, bleeding, employed merely to counteract the convulsive movements, will be found unattended by good results. In advanced cases, again, of injury of the head, the occurrence of convulsions is by no means to be considered as sufficient warrant for continuance and *pushing* of the antiphlogistics—especially blood-letting ; for, often, they are found to be of an asthenic, or purely nervous character ; aggravated by antiphlogistics, alleviated and checked by amendment of diet and soothing measures.

The brain and membranes, having recovered from the inflammatory process, remain long weak, and require still a watchful and patient care. Light and noise must not be soon or abruptly admitted. Conversation, reading, thought, or other exercise of the mental powers, must be discouraged. Even the functions of special sense should be held in comparative abeyance. The head is shaved, elevated, and kept cool. Food is sparing and non-stimulant. The bowels are kept freely moving.

If resolution do not occur, symptoms of compression of the brain supervene on those of concussion ; coma is formed ; and the case becomes one of the utmost danger. There is now no tolerance of active antiphlogistics. The lancet is laid aside. Purging is cautiously continued. And the main reliance is placed on powerful counter-irritation.

Even where inflammatory symptoms have not been urgent, recovery from concussion is often tedious, and imperfect. The eye remains wild and vacant in expression ; memory is impaired ; conversation is childish, and often incoherent ; sometimes the demeanour is timid and gentle ; sometimes the patient is very irascible, and apt to be moved to much violence. In short, there remains an imbecility of the whole mental powers. In other cases, certain only of the mental faculties thus suffer ; and of these, memory is the one most frequently affected. Sometimes the recollection of all past events is either lost or obscured ; sometimes a portion of these remain tolerably vivid and distinct. Sometimes the past is untouched, and the present only affected. Extraordinary results have occurred, in regard to languages ; when the knowledge of a plurality of these has been previously possessed by the patient. Certain of them have gone quite from him ; and on recovery from the first effects of concussion he has spoken with fluency, and continued to do so, in a tongue to which he had been long a stranger.*

Again, intellect may remain clear and entire, while special sense sustains an injury. Hearing and smell may be lost, impaired, or perverted. Weakness of sight, with or without squinting, is no uncommon result. Confirmed epilepsy may become established.

Such remote and chronic consequences of concussion may prove but temporary ; or they may remain for life. The affections of the mind are especially liable to prove obstinate ; and ought always to receive a very guarded prognosis. The treatment found most suitable consists in a mild alterative mercurial course, with moderate and long-continued counter-irritation ; an uniformly lax state of the bowels, and occasional purging ; a most carefully regulated diet ; restriction to moderate exercise of both body and mind, but more especially of the latter ; avoidance of all sources of mental excitement, especially of such as are known to be besetting to

* Sir A. COOPER'S Lectures, p. 112.

the patient ; the use of the cold shower-bath ; and residence in genial exposure and climate.

Many patients recover, to all appearance, perfectly from concussion ; and yet are subject to frequent and unpleasant remembrances of the injury. On attempting any unusual exertion, either of mind or body, or on the occurrence of any otherwise trifling stomachic or intestinal disorder, intense headach supervenes, with some fever, and perhaps attended with disorder of sight or other special sense. Or, by even slight indulgence in wine, they are liable to undergo great mental excitement, little short of temporary delirium or insanity. Such persons, it is obvious, ought to pay great attention to regimen, to the state of the bowels, and to the avoidance of all circumstances likely to excite, or cause determination to the cranial contents. Indeed, it may be laid down as a safe general rule, that all who have once sustained any considerable concussion of the brain must ever after regard their head as a weak point, which requires constant prophylactic care. And, for some time immediately succeeding the infliction of the injury, this truth should be more especially forced upon them. For many most serious cerebral disorders have been the result of premature return to bodily exercise, mental occupation, or pleasures of the table, after a concussion thought at the time to be but trivial.

A very insidious, and consequently dangerous, affection of the brain or its membranes is apt to ensue as a remote consequence of concussion, more especially in young people. A slight injury of the head has been received, by a blow or fall ; and its immediate effects seem to be satisfactorily recovered from. Weeks—or, it may be, months—afterwards, the patient is out of health ; he loses colour, appetite, flesh, and energy both of body and mind ; he is subject to headach, and occasionally complains of giddiness ; the skin is dry and feverish, the tongue coated with a yellowish white fur ; the secretions are altered ; the eye has an unwonted expression, rather of languor than of excitement ; the stomach is irritable, and occasionally rejects food ; sleep is disturbed and unrefreshing, the pulse continues small and frequent, or preternaturally slow. The ordinary remedies, directed to stomach, skin, and bowels, fail to relieve. The general ailment continues slowly to advance. By and by, the head symptoms assume a pre-eminence ; and at no distant period from that event, symptoms of pressure on the brain become plainly manifest. Most probably the issue is fatal. An inflammatory process has been slowly advancing in the membranes of the brain, or even the cerebral substance ; suppuration has at length occurred ; and, in consequence, it is not unlikely that an acute accession has supervened on the previous chronic change of structure.

It is very obvious how the inobservant practitioner must be apt to mistake the true nature of such cases. The head is not suspected of originating the evil, until towards the close ; when treatment, however suitable, can prove of but little avail. Diet is attended to, laxatives are given, then alteratives ; and then, probably, tonics ; all without relief ; the last class of remedies inevitably inducing marked aggravation of the disorder. It may be that the treatment is from the first of a tonic nature, and blindly persevered in, notwithstanding its manifest failure ;

the result is consequently still more untoward; and coma is rendered more early, more urgent, and more hopeless, than it otherwise might have been. The treatment, on the contrary, should be such as to counteract a chronic inflammatory process; conducted with such care and skill as the importance of the texture implicated so imperatively demands. Leeches are applied to the temples or occiput; and are repeated, perhaps, once and again. The head is shaved, and counter-irritation by blisters is patiently maintained. A mild course of mercury is given. The intestinal and other excretions are attended to; smart purgation having a wonderful effect in such cases. Diet is sparing, and most carefully regulated. All excitement of both body and mind is avoided. And such treatment must be duly maintained, notwithstanding the patient, or other inexperienced observers, may not scruple to say that its rigour is quite disproportionate to the importance of the case. The skilful surgeon knows the insidious and covert nature of the evil with which he is called upon to cope; and is not deceived by appearances. His main difficulty may lie in enforcing the measures which he knows to be essential. It were well that patients were in general as fully convinced, as are the members of the medical profession, of the truthfulness of the axiom, that "no injury of the head is too slight to be despised;" and that whenever any serious concussion has been sustained, the greatest prophylactic caution is expedient, long after the infliction of the injury.*

It is needless to expose the unsuitableness of the operation of trephining, in all cases of simple concussion; but conditions may arise in consequence of such injuries of the head, where, at a later period, when the inflammatory process has set in, attended by special symptoms to which we shall have afterwards more fully to allude, the use of the trephine affords the only chance of saving a patient from imminent peril.

Compression of the Brain.

It is unnecessary here to consider the question, Whether the substance of the brain is capable of condensation by pressure or not. We know that pressure applied to it, according to its suddenness and intensity of application, produces derangement of the functions of that important texture; and the consequent train of symptoms, varying in degree, are usually termed those of "compressed brain," or of "compression."

In concussion, the whole brain is more or less affected; in compression, a portion only may be acted on. In the one case, the cause of disorder is of temporary application; in the other, it is of some duration. The symptoms, therefore, may naturally be expected to differ. In concussion, the depressing effect on the heart and general circulation is immediate and prominent; and the patient lies pale, cold, and pulseless.

* "It will in general be found very difficult to persuade a person who has had what may be called only a knock on the pate, to submit to discipline, especially if he find himself tolerably well. He will be inclined to think that the surgeon is either unnecessarily apprehensive, or guilty of a much worse fault; and yet, in many instances, the timely use or the neglect of this single remedy (blood-letting) makes all the difference between safety and fatality."—PORT, i. 47.

In compression—the injury being usually limited to but a part of the brain—the heart's action may, at first, be little if at all affected; the skin, consequently, may retain its natural warmth and hue, and the pulse its fulness. In concussion immediately fatal, death takes place by syncope. In compression, the fatal result is due to coma. The essential peculiarity of the latter is, “that respiration takes place imperfectly, and ultimately is suspended, probably by reason of the defect of sensation. The circulation, and sometimes the animal heat, not only continue entire up to the moment when the last breath is drawn, but even survive the respiration for a short time; during which time, of course, venous blood moves along the arteries; but the venous blood, according to the general law established in the physiology of respiration, soon ceases to make its way through the capillaries of the lungs, and the circulation is therefore soon brought to a stand We know from physiology, that the part of the nervous system which must be specially affected in these cases, when the failure of respiration is the immediate cause of death, must be at the sides of the medulla oblongata; but the part visibly injured is often considerably distant from this.”*

Pressure may be made on the brain in various ways. By extravasation of blood; in its substance, on its surface, or between the membranes. By formation and accumulation of pus, or other products of the inflammatory process—either cerebral or intra-membranous. By fracture of the cranium, with depression of the broken part or parts. By lodgment of foreign bodies in the brain, or on its surface. By the formation of adventitious growth, in connection with either the cranium or its contents; exostosis, osteosarcoma, or osteocephaloma of the cranium; tubercular, or other tumour of the brain or its membranes. It is probable that compression is also occasioned by mere congestion; a state of over-distension of the blood-vessels, with accumulation of serous product.

It is highly important to bear in remembrance, that symptoms precisely similar to those ordinarily produced by compression of the brain may be, and frequently are, induced by other circumstances, when no apparent pressure is in operation. Certain poisons, for example, have this effect. But—what is of more consequence in a surgical point of view—such a train of symptoms almost invariably attends on disorganization of the cerebral tissue by inflammatory change; and that, too, when the inflammatory products seem to be of such a nature as not to occasion pressure in any great degree.

In surgery, we have chiefly to do with those examples which are induced—*First*, by external violence, producing depressed fracture, or extravasation of blood; or *Second*, those which are a more or less distant result of injury inflicted on the head—viz. inflammatory change; serous and fibrinous accumulation, and suppuration.

Symptoms of Compression.—In all these conditions, the most characteristic symptoms are found affecting the respiration and the pulse. Breathing is slow, labouring, and loudly stertorous; in concussion it was gentle and sighing. A peculiar whiffing, by the mouth, is not uncommon during expiration—as is observed in smoking, or in the ordinary

* ALISON, *Outlines of Pathology*, p. 8.

repose of heavy sleepers ; it is a symptom of untoward portent. The pulse is distinct and full, usually slow, but often at first not much altered as to frequency—not unfrequently intermittent ; in concussion it was from the first rapid, low, and feeble, perhaps wholly imperceptible. When the morbid condition is fully developed, loss of consciousness is more complete than in concussion ; the patient cannot be roused by any movement or noise. Loss of sensation, too, is more complete ; he may be pinched, or burnt, without in any way evincing perception of pain. Special sense is wholly dormant ; he neither sees, nor hears, nor smells ; at least no result follows the application of stimuli to the eye, ear, or nose. Power of motion is wholly gone ; the voluntary muscles are relaxed, flabby, and powerless ; the limbs lie loose and incapable of motion. The eye is fixed ; its pupils are dilated and insensible to light. The skin is of a normal temperature, or perhaps even warmer ; not unfrequently wet with perspiration ; in concussion it was cold, pale, and shrunken. The sphincters are relaxed ; fæces pass involuntarily. Expulsive muscles are similarly affected ; the urine is, in consequence, retained ; or, from paralysis of the sphincter as well, the urine may pass off involuntarily, not in a stream, but by drops.

Such is the general character of the symptoms peculiar to compression ; varying, of course, in degree, according to the amount or nature of the injury sustained. They are of immediate or secondary accession, according to the cause ; immediate, when the consequence of sudden hemorrhage, depressed bone, or impacted foreign body ; secondary, when the result of tardy extravasation, suppuration, or inflammatory product. However originating, they are, after a time, masked and modified by the results of the inflammatory process which seldom fails to become established in the injured part.

But the brain has the power of recovering from the effects of pressure to a certain extent, even although the agent of compression undergo no alteration ; the organ seeming to accommodate itself gradually to its change of circumstances. Thus, in depressed fracture, symptoms of compression may be at first marked and even urgent ; and yet may pass off in a day or two, without any elevation of the depressed portion of bone. This being borne in mind, we can readily understand how, by the time that the inflammatory process has begun, the symptoms of compression, at first considerable, may have in a great measure passed away ; and how the case, consequently, may for a time present only the ordinary symptoms of urgent inflammatory affection of the brain and its membranes. This is something more than mere masking of compression by the inflammatory process ; it is supersedence. Certain functions of the brain are plainly re-established, though perverted ; convulsive movements of the limbs occur, and delirium may supervene.

Compression may, like concussion, prove directly fatal ; the patient perishing by coma. Or—when the cause of pressure is removed, or even as already stated, independently of this—the symptoms gradually abate, and the patient slowly recovers. Or, ere yet any great mitigation in the symptoms of compression have occurred, those of an urgent inflammatory process kindled in the injured part become established ; and these prove fatal. Or a similarly fatal issue may take place, through inflammatory

change, even although the immediate effects of compression had seemed to have been recovered from.

The indications of treatment adapted to compression are sufficiently simple. To remove, if possible, the compressing cause. To watch the subsequent favourable progress of the organ to resumption of its normal state and function. To interfere, if need be, to avert the inflammatory process. And to oppose the untoward advance of this, when unfortunately it has become established. When symptoms of simple compression persist, without any opportunity being afforded of removing the cause of pressure, to maintain by suitable means the action of the heart and lungs ; so as, if possible, to afford time for the brain, by accommodating itself to its altered circumstances, slowly and imperfectly to resume its functions.

Between pure examples of Concussion and Compression of the brain there is no difficulty in drawing a sufficiently broad distinction ; in practice, as well as in theory. The one, a case of syncope ; the other, of coma. In concussion—the symptoms immediate ; insensibility usually incomplete ; the organs of special sense capable of being roused ; the muscles contractile, and the limbs, under strong stimulus, undergoing movement ; the breathing soft and gentle ; the pupils not uniformly dilated, though insensible to light ; the pulse rapid, small, indistinct ; perhaps for a time imperceptible ; vomiting ; no involuntary evacuations ; the skin cold, pale, and shrunk. In compression—the symptoms not necessarily immediate ; insensibility complete ; the organs of special sense incapable of being roused ; the muscles relaxed, paralyzed ; the limbs motionless, until recession of the state of compression, and advance of the inflammatory process ; breathing laboured, slow, and snoring ; the pupils dilated and insensible ; the pulse slow, distinct, perhaps full, sometimes intermittent ; no (or seldom) vomiting ; fæces passed involuntarily ; retention or dribbling of urine ; the skin warm, and often bedewed by perspiration.

But it is very plain that comparatively seldom will pure examples of either state be presented to the surgeon. The blow or fall which produces severe concussion is very frequently accompanied by laceration of the substance of the brain, or rupture of a vessel in the membranes, whence blood will escape, sooner or later, inducing a certain amount of compression. And, on the other hand, the injury which causes compression, whether by fracture or extravasation, must, at the same time and primarily, have caused more or less concussion. In consequence the two states, and their corresponding symptoms, are often—nay, usually—more or less commingled. According to the preponderance of either class of symptoms, the case receives its title ; and, sometimes, it is not easy to say to what side the preponderance is inclined.

There is one class of cases, however, sufficiently distinct. The ordinary symptoms of concussion follow an injury of the head, and the patient rallies from them. Consciousness is completely restored, and is retained for some time. But without the operation of any new external cause, insensibility returns ; unconsciousness is more complete than be

fore ; and the symptoms now will be found presenting the characters of coma. Here is a combination of concussion with compression ; yet there is no difficulty in separating the case into its two component parts. The first insensibility was that of concussion ; the second is undoubtedly due to compression. If the interval of consciousness have been brief—of hours—the compressing agent is, doubtless, extravasated blood ; if it have been of considerable duration—days—the compressing agent is pus, or other inflammatory product.

It is right also to remember that, not unfrequently, part of the insensibility attendant on injuries of the head may be attributable to intoxication ; and that although this is of a transient nature, and to that extent favourable, yet that it predisposes to inflammatory accession. Again, the coma may be of uræmia, or of poisoning by opium ; and not directly connected with injury of the head, real or supposed.

Compression by Extravasation of Blood.

Escape of blood may take place, immediately on infliction of the injury ; or not until reaction has followed the direct effects of concussion. During the depressed state of circulation which obtains during the first effect of the injury, no blood may escape from even extensive cerebral laceration ; but if reaction be both speedy and intense, even the slightest lesion will be certain to afford a dangerous amount of that fluid.

The extravasation may be variously situated : between the skull and dura mater ; between the membranes ; on the surface of the brain—on its hemispheres, or at its base ; within the ventricles ; or infiltrated into broken-up cerebral substance. For practical purposes, it is sufficient to divide compressing extravasations into two great classes ; those which are exterior to the dura mater, and those which are within that membrane.

I.—Extravasation between the Bone and Dura Mater.

One of the effects of a fall or blow on the head is, by disruption of the soft parts constituting the scalp, to produce more or less swelling by sanguineous infiltration of that texture. Occasionally, a similar result is produced on the internal aspect of the part of the cranium struck, in the areolar and vascular connections of the dura mater with the bone. These being torn, escape of blood follows ; either at the time, or subsequently on reaction ; or at both periods ; sparingly at first, more profusely afterwards. If any considerable vessel have been torn, the extravasation may be expected to be both instant and considerable. By such abnormal accumulation of blood, the dura mater is proportionately bulged inwards ; and compression of the brain necessarily results. The blood, as in other examples of extravasation, is at first fluid, but sooner or later assumes the form of a solid cake, with a somewhat coarsely granular texture, the serum of coagulation having become absorbed.

Extreme cases of this nature, it is plain, are most likely to occur when the injury has been inflicted in the course of the larger sinuses, or of the middle meningeal artery. And here the quantity of extravasated

blood may amount to several ounces. It is well to remember, however, that to occasion such results, it is not essential that fracture of the superimposed bone should take place. Mere concussion may suffice. If compound fracture exist, the blood is more likely to escape externally, than to accumulate, to any inconvenient amount, between the bone and membrane.

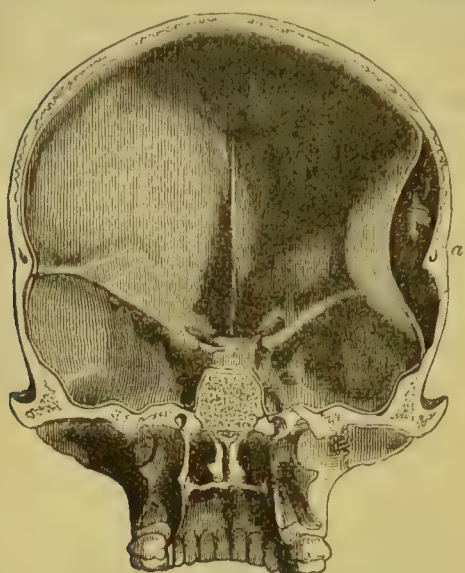


Fig. 233.

As indications of the event :— In addition to the ordinary symptoms of compression, we have the peculiar site and nature of the injury. A smart blow has been received in the course of the meningeal artery, or of the lateral sinuses, or at the sites of contrecoup; and is speedily followed by urgent symptoms of compression.

Such compression may be so grave as to cause death, by its direct effect. Or, farther escape of blood ceasing, the brain begins to accommodate itself to the amount of pressure already applied; at the same time the compressing agent is being gradually diminished in bulk by absorption of the extravasated blood; and the patient slowly recovers. Or the inflammatory process is kindled after a time; and unhealthy suppuration ushered in by rigors, is apt to ensue; reinducing symptoms of compression, more urgent than before, after perhaps a considerable interval of consciousness.

Treatment.—Were the circumstances of the case such as to leave little doubt as to the occurrence of this form of extravasation, at an accessible and defined portion of the skull, we need have no hesitation—the symptoms of compression are urgent—in using the trephine; for the purpose of exposing the supposed site of extravasation, and hoping it afford relief by evacuation. If the blood be still fluid, it would escape at once; if coagulated, the solid portions might possibly be detached by a probe—delicately used.

Unfortunately, however, we cannot be certain, in almost any case, the exact site of the extravasation; and, consequently, both our operation and prognosis should, in such circumstances, be extremely guarded. A concussing blow operates chiefly on two parts of the cranium; the part struck, and the part immediately opposite; the one effect often termed the *coup*, the other the *contrecoup*. It not unfrequently happens that extravasation takes place in the latter situation; not at the part struck. And should we find nothing to corroborate our diagnosis in the first situation, we are certainly not warranted in making a similar attempt at the other; for the extravasation may be yet elsewhere, its site not ascertained—perhaps, indeed, inaccessible.

If the symptoms of compression be not urgent, of course there is

Fig. 233. Extravasation of blood, separating the dura mater from the cranium at the ordinary site; by rupture of the middle meningeal artery, *a*.

propriety in interfering by operation. We watch the patient, as in a case of concussion, ready to meet any symptoms which may appear. The brain gradually recovers. The extravasation is slowly absorbed. Our duty is to avert the inflammatory process, if possible, by the ordinary means ; to moderate it, should it occur. And we should ever remember that perforation of the cranium, by means of the trephine, even should we be fortunate enough to light upon the site of the extravasation, is far more likely to set up than prevent the access of inflammatory mischief.

II.—*Extravasation of Blood on or in the Brain.*

As already stated, the blood may be variously situated ; intra-membranous ; in the *pia mater*, and diffused on the surface of the hemispheres ; or at the base of the brain ; or within the ventricles ; or infiltrated into the cerebral tissue. And, unfortunately, the most careful examination of the history, symptoms, and progress of the case, will often not enable us to ascertain, with anything like certainty, the exact site of the evil.

The symptoms are those of compression, more or less urgent in their character, and more or less speedy in their accession, according to the site, amount, rapidity, and time of the extravasation. Usually, the escape of blood is not immediate—at least to such an extent as to cause symptoms of decided compression—but secondary, on the occurrence of reaction. The patient may have been from the first insensible, by concussion ; and this minor insensibility may be simply merged in the major insensibility of compression ; or between the two there may be a greater or less interval of consciousness. The cerebral or membranous lesion, which permits the sanguineous escape, may follow on a concussive injury of the cranium ; on extensive fracture of the cranium, with or without depression ; on mere fissure of the skull—more especially when this is situate at the base ; or on a penetrating wound, of any kind.

There is the same prognosis as in the case of extravasation exterior to the dura mater. The brain may recover, and the extravasation be absorbed ; or the brain, recovering partially from compression, suffers, perhaps fatally, by inflammatory accession—immediate or remote ; or the compression is most urgent, and directly terminates existence by coma. Rapidity of extravasation is more important than the amount ; and the site of the escape is of more consequence than either. A comparatively small quantity of blood rapidly, or at once, extravasated, will induce more urgent symptoms of compression than twice the amount which has slowly oozed from the torn vessels ; and while a large flat coagulum may press with comparative impunity on the upper and anterior part of the hemispheres, a slight amount of blood acting on the base of the brain—more especially at its posterior part—never fails to induce the most serious and urgent consequences.

Treatment.—Prevention may be in our power. Concussion may occur, along with slight lesion of the cerebral substance ; and from this lesion little or no blood may escape during the period of depression. The injury having been such as to engender a suspicion of these circumstances, it is plainly our duty to protract and repress reaction ; when it

does occur, to endeavour that it proceed slowly and calmly ; or, if need be, by bleeding from the system, to reinduce the state of depression, and maintain it during a second period—the object being to afford time and opportunity for efficient occlusion of the injured vessels by natural hemostatics. If too late, or otherwise unable, to prevent, we may yet hope to moderate and limit the extravasation. And this is to be effected by opposing reaction ; keeping the patient quiet, with the head elevated ; applying cold to the head, face, and neck ; interdicting all nutritive ingesta ; taking blood from the system, as circumstances may require ; and acting freely on the bowels by purgatives. Our object still is to have not only the general circulation quiet and gentle, but to have blood circulating within the cranium as sparingly and as calmly as is compatible with such maintenance of the cerebral functions as is essential to life.

Extravasation having ceased, we hope that in due time the symptoms of compression will begin to abate ; the brain accommodating itself to the compressing agent, and this latter beginning to diminish by absorption. We ward off inflammatory symptoms, should they threaten ; and maintain strict rest, quietude, and regimen ; the last being very rigidly limited in regard to both fluids and solids, in order that there may be a state of system not only unfavourable to inflammatory accession, but also favourable to absorption of the extravasated blood. Unfortunately, we have no direct means of assisting in the latter indication. We learn, too, from the observations of Mr. Prescott Hewett and others, that such extravasations, occurring within the cavity of the arachnoid, tend to be transformed into false membranes, or to become encysted ; and the membranous layers or cysts, remaining attached to the parietal arachnoid, are permeated by an ample supply of blood-vessels. Hence they become permanent structures, and by their pressure produce changes in the form of the portion of brain with which they are in contact.*

A paramount indication undoubtedly is, removal of the compressing cause, the extravasation. This can be artificially effected only by operation ; by removing a portion of the cranium ; puncturing the membranes if need be ; exposing the site of extravasation, and permitting—if no effecting—external discharge. Were the operation of trephining capable always, or even often, of achieving this result, it would be held a generally advisable in such cases. As it is, however, the profession is much divided upon the question ; some in favour of, others opposed to the proceeding. Among the latter, we would beg to be enrolled ; and for the following reasons :—1. (Waiving the difficulties connected with the diagnosis of extravasation as a cause of compression) It is difficult, not impossible, to determine at what part of the *periphery* of the cranial cavity the extravasation has occurred ; whether at the point struck, or at the site of the *contrecoup*, or at some other part—superiorly, or laterally, or at the base. 2. It is equally difficult, if not impossible, to determine previous to the operation, at what part the extravasation has occurred ; regards the *diameter* of the cranial cavity ; whether between the membranes on the surface of the brain, within its ventricles, or in its broken

* Prescott Hewett, Med. Chirurg. Trans. vol. xxviii. p. 45. Lerich, Bull. de Soc. Anat. de Paris, t. x. p. 55. Quain, Trans. Path. Soc. Lond. vol. vi. p. 8.

up tissue. 3. Supposing that the extravasation has been reached and exposed, it may be found either difficult or impossible to effect its removal. Coagulation has taken place. The fluid portion trickles away at once; but the clot is expanded in the form of a flat and broad layer, which cannot be dislodged and extruded without the infliction of such further mechanical injury as shall render the occurrence of disastrous inflammatory accession inevitably certain. 4. Supposing that the coagulum has been exposed and not removed, the patient is obviously much more unfavourably situated after than before the operation. Now there is a certainty of inflammatory accession—in addition to the unrelieved evil of compression; and, under the combination, it is but too likely that life may give way. Before, there was but the compression; the inflammatory process might have been averted; the brain, by accommodation, might have gradually recovered.

Thus, then, we hold, that in the case of compression by extravasated blood, the operation of trephining is to be considered as generally inapplicable. No man can be sure that the symptoms are due to extravasation of blood; for concussion of the brain, in its severer forms, will frequently give rise to symptoms so closely allied, that diagnosis of the actual structural changes must be a matter of pure hypothesis. Operating, we are uncertain whether or not the trephine is over the site of extravasation; we are uncertain whether it may be necessary to puncture the membranes of the brain—and, that having been done, we may still fail in exposing the blood; we are uncertain of being able to remove the blood, even after it has been exposed; and we are almost certain to light up an inflammatory process of a most urgent, and perhaps unmanageable, character. In other words, we are sure to inflict injury—by perforation, and exposure; we *may* succeed in counterbalancing this injury by a preponderating amount of benefit—by extrusion of the compressing agent, the escaped blood; but we are fully more likely to fail in obtaining the contemplated advantage; and then the proceeding proves to be altogether injurious.

But to all general rules there are exceptions. And here the exception consists in those cases of injury applied in the course of the middle meningeal artery, immediately followed by urgent symptoms of compression, with or without fracture of the skull, in which we can have little doubt of the following circumstances:—1. That the compression is caused by extravasation of blood, while the symptoms are so urgent and gravescent that, unless relief be afforded, death will speedily ensue; 2. That the blood has been extravasated at or near the point struck; 3. That the extravasation is situate exteriorly to the dura mater; 4. That the blood is yet mainly fluid, and therefore likely to escape readily outwards, on an aperture of communication being established; 5. That even if it have coagulated, extrusion may yet be effected, without necessarily exciting inflammatory mischief, either in the brain or in any of its membranes. Under such circumstances, we need not hesitate to apply a trephine to the injured part, with the full hope of affording most important and salutary relief.

We can also conceive it possible, that an injury may be sustained at a part of the cranium not connected with the course of the meningeal artery; that the symptoms of compression by extravasation may be both very urgent and very plain; and that the surgeon, after careful examination and consideration of the case, may feel satisfied that the site of extravasation corresponds to the part struck. The trephine is applied. If blood be found at that part, exterior to the dura mater, the issue is most fortunate. But if no blood be found, two questions naturally arise: Are the membranes of the brain to be perforated? or is another part of the cranial contents to be exposed by reapplication of the trephine? The latter question is certainly to be answered in the negative; the former, in the affirmative, only when the dura mater is elevated through the trephine-hole, tense, comparatively non-pulsating, perhaps fluctuating, or otherwise affording tolerably distinct evidence of the sought-for blood being lodged beneath, and in an encysted condition.

Compression by the Accumulation of Pus between the Cranium and Dura Mater.

Such an occurrence may be preceded or not by sanguineous extravasation. There may be at first disruption of the dura mater from the internal surface of the cranium, with accumulation of blood between; perhaps to such an extent as to cause compression of the brain. This organ slowly recovers; and the patient seems convalescent. But, after some interval, varying from days to weeks, the inflammatory process is kindled in the injured part; suppuration occurs, and the internal bruise degenerates into an unhealthy abscess.

Or there may be no previous extravasation. The bone and dura mater sustain a shock by the injury, but undergo no disruption either of themselves or of their connections. There may be at first some symptoms of concussion, and these pass away; but convalescence is interrupted by febrile disturbance of the system, followed by symptoms of compression. The inflammatory process has been established in the cranium, in the dura mater, or in both; and abscess forms between. The inflammatory process may have originated in the membrane, or in the connections of this with the bone, or in the bone; or it may have begun in the diploë, causing abscess there, and extending inwards; or the origin may have been exterior to the cranium, in the soft parts, secondarily involving the corresponding portion of the interior.

If a portion of the cranium have been rudely stripped of its pericranium, it may die; but it does not necessarily do so—as was formerly stated. Should necrosis take place, and involve the whole thickness of the skull at that point, there is necessarily detachment of the dura mater interposition of pus between it and the bone, consequent bulging inwards of the membrane, and proportionate compression of the brain.

But detachment of the pericranium, with advancing necrosis of the external part of the bone, does not necessarily imply a corresponding state of matters within. The issue may be, and often is, merely an external exfoliation.

The dura mater is a more important and efficient membrane than

the pericranium, as regards vascular nutrition of the bone. Detach the dura mater, and the bone may hardly live ; strip off the pericranium, and exfoliation is by no means inevitable.

If the injury have not only denuded the external table of its investing membrane, but have also removed, at a corresponding point, the dura mater, by disruption and consequent extravasation, necrosis of the portion of bone so circumstanced, necessarily involving accumulation of pus between the dura mater and cranium, is inevitable. Also, if the dura mater be alone detached, and subsequently suppurate, necrosis of the entire thickness of the bone is still more than probable ; though there may not be even an external wound.

However occasioned, the symptoms of compression from this cause differ very obviously from those produced by extravasation of blood. They are not of early occurrence ; days, and sometimes weeks, elapse between their accession and the infliction of the original injury. Whereas, compression by escape of blood is either immediate, or removed from the time of infliction only to the extent of a few hours, at the utmost. Also, in the case of abscess, the symptoms of compression are invariably preceded by signs of the inflammatory process which causes the suppuration. As regards the result, the difference is still more striking. In compression by blood, the extravasation may cease, the blood is absorbed, and the brain recovers. But, in compression by pus, the compressing agent is ever on the increase ; the abscess enlarges more and more ; and pus is but little amenable to absorption. The bone is exfoliating, and, if it were separate, the matter would doubtless find an outward escape ; but exfoliation is a tedious process ; ere it has been accomplished, the membrane, growing more and more tense, and itself involved in structural change, ulcerates, or sloughs ; purulent irruption takes place inwards ; and a more extensive, serious, and uncontrollable inflammatory accession necessarily ensues. Or, previous to the giving way of the dura mater, an equally fatal inflammatory extension inwards, by contiguity, may have occurred, diffuse arachnitis, accompanied by suppuration within the cavity of the membrane, having been set up at a comparatively early period. Or a sad complication may take place, by invasion of all the symptoms of pyæmia. Or, independently of any such aggravations, the primary evils of fever and compression may prove fatal.

The symptoms denoting formation of this dangerous abscess are twofold ; as affecting the system ; and as affecting the part. A man receives an injury of the head, without fracture of the cranium. He may undergo concussion, or compression by extravasation ; one or other, or both ; or he may not. If he does so suffer, he rallies ; and, for a time, seems advancing favourably towards complete recovery. But, after some days, he becomes restless, wakeful, and generally uneasy ; his pulse rises and gets hard ; his skin is hot and dry ; and the other symptoms of inflammatory fever present themselves—moderate or intense, obscure or manifest, according as the inflammatory process happens to be chronic or acute ; very frequently it is the former. Pain is complained of in the head ; the eyes change their expression ; and the cerebral functions begin to evince disorder. Rigor occurs, and is repeated. Suppuration is begun ; and then supervene, more or less rapidly, the symptoms of compression—coma and

hemiplegia—masking, in their turn, those of the inflammatory character. Then, as to the part. The bone is in a state of necrosis; and this condition will certainly be indicated externally. If there be a wound, the granulations, instead of presenting the appearance of health and healing, will disappear, or become pale and glassy; and the discharge may for a time cease—returning thin, non-laudable, perhaps sanguineous. If the pericranium be exposed, it will be found separating more and more from the bone beneath, with pus interposed. If the bone be denuded, it will

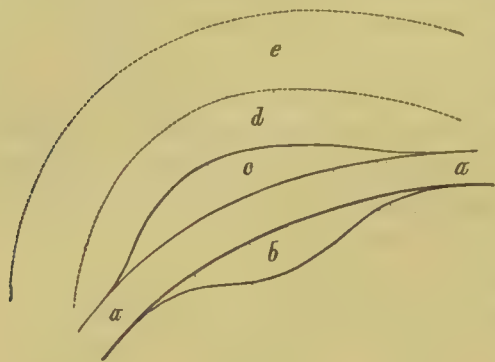


Fig. 234.

be found white, dry, sonorous, non-vascular—in fact, at first dying, and then speedily dead. If the scalp have not been divided either by accident or by design, it is the seat of what is termed “the puffy tumour;” a swelling of greater or less extent, caused partly by accumulation of pus between the necrosed bone and its pericranium, partly by change of structure in the soft parts ex-

teriorly, which are involved more or less in the extending inflammatory process, and are consequently the seat of the inflammatory products. Indeed, this “puffy tumour,” though a valuable and peculiar sign of the internal evil, is not to be regarded as of a special nature; being only the ordinary product of ripe inflammatory change; oedema by serum externally, fibrinous product more deeply, and accumulated pus overlaying the bone.

These symptoms, local and constitutional, occurring together, denote interior suppuration at the injured part. The local signs “following a smart blow on the head, and attended with languor, pain, restlessness, watching, quick pulse, headach, and slight irregular shiverings, do almost infallibly indicate an inflamed dura mater, and pus either forming or formed between it and the cranium.”*

Treatment.—The general principles applicable to the treatment of abscess must be carried out, if possible. The pus must be evacuated externally; and that at as early a period as possible; as soon as we are satisfied, by conjunction of the local and constitutional signs, that matter has formed. The local symptoms alone are not a sufficient warrant for operative interference; neither are the constitutional ones of febrile excitement followed by rigors; but when coma, with hemiplegia on the side opposite to that where the injury has been inflicted, and the puffy scalp or dry glassy wound co-exist, they render the diagnosis of pus or curdly lymph between the dura mater and skull almost absolute, and certainly

* POTT, vol. i. p. 41.

Fig. 234. Plan, illustrative of abscess of the dura mater. *a*, the cranium; *b*, suppurated space left by detachment of the dura mater; *c*, ditto, by elevation of the pericranium; *b* and *c* constitute the suppurated central space of the inflammatory disc; *d*, the arc of plastic change; *e*, that of serous product; *c*, *d*, *e*, constituting Pott's puffy tumour.

indicate the propriety of resorting to the use of the trephine. By this instrument—chosen of a large size, to make the probability all the greater of disclosing the suppurated part—the dead portion of bone is perforated ; with the hope that the abscess may be discharged externally, with relief to the symptoms of compression. Be it remembered, however, that, even in the most satisfactory cases, the symptoms of inflammatory change still remain, affecting in all probability the visceral layers of the membranes of the brain. Antiphlogistics must still be continued, therefore ; and much careful management is required, even in the most favourable cases, ere the patient is conducted to safe completion of the cure. It may happen that the inflammatory progress is not checked ; but, spreading both widely and in depth, proves ultimately fatal. In short, while it is obvious that the only chance of the patient's safety is by artificial evacuation of the matter, it is equally plain that the operation alone will not suffice, but must be followed up by the most careful general treatment. For the experience of most practical surgeons of the present day differs very materially from the recorded successes of Pott ; in whose hands a satisfactory result appears to have been the rule, failure quite the exception. Nay, even when all the symptoms mentioned have been present, perforation of the cranium at the injured part has failed to disclose any depôt of pus ; and even where success has so far crowned our efforts to relieve these urgent symptoms, the evacuation of the pus has failed to save the patient—the diffuse suppuration of the arachnoid having apparently progressed commensurably with the formation of pus external to the dura mater.

On the other hand, it sometimes happens, in fractures of the base of the skull, that an abscess, burrowing between the dura mater and bone, has eventually reached the middle ear, and discharged itself externally by the meatus ; the patient recovering. But, obviously, such an occurrence is a rare exception to the general rule, and cannot be trusted to in practice.

If, on removing a portion of skull by the trephine, matter is not found, or the symptoms continue unrelieved, a question arises whether our efforts at direct relief are to cease, or whether further exploration is to be attempted. Is the dura mater to be perforated, in the hope that the site of abscess may prove to be beneath ? Not, if the membrane present its usual normal characters at the part exposed ; level, moving synchronously with the cerebral mass, smooth, of a greyish hue, and shewing something of a silvery lustre. But if it be protruding through the cranial aperture, flocculent, non-pulsating, and either too dark or too pale in colour—and, more especially, if it afford anything of a feeling of fluctuation when touched—we need not, in the desperate condition of the patient, hesitate to puncture ; and may hope to find a circumscribed collection of purulent matter in the cavity of the arachnoid, which our incision has sufficed to evacuate. If the dura mater appear sound, and its puncture consequently be unwarrantable, are we permitted to reapply the trephine ; either at the site of *contrecoup*, or in the immediate vicinity of the first application ? Either of these procedures may be warrantable, if the symptoms of dura matral abscess are peculiarly marked, and the surgeon is thoroughly convinced of its existence. But, as can

readily be understood, the latter site of reapplication is preferable. And, as already stated, a large size of trephine should be employed at first, to anticipate the necessity of such repetition. Only in very extreme cases should the site of *contrecoup* be trephined. Having failed in the indicated spot, we proceed to other explorations with great uncertainty. Fortunately, however, it is comparatively seldom that the site of abscess is elsewhere than at the injured part, when such requirements for the performance of the operation are satisfactorily recognised before proceeding to perforate the skull.

But, if the case be under our cognizance from the first, we have a higher aim than the mere exercise of our art by operation; seeking to prevent the formation of abscess, not to attempt its cure. The patient, who has sustained an injury of the head, of any severity, is carefully watched throughout the whole period of convalescence; and the first symptoms of inflammatory accession within the cranium are met by active and sustained antiphlogistics—more especially blood-letting, quietude, avoidance of all stimuli of both part and system, low diet, purgatives, and perhaps calomel; assisted, if need be, after a time, by counter-irritation. In spite, however, of every care and any treatment, experience has unfortunately proved, only too surely, that where the inflammatory process commences in the bone or dura mater at the seat of injury, the affection generally runs its fatal course unchecked by treatment.

When suppuration has taken place either in the substance of the brain or on its surface, the case is obviously not amenable under ordinary circumstances to direct surgical interference, and may generally be said to prove fatal. Still in any case where it has been deemed expedient to perforate the cranium and divide the dura mater in search of pus, if we should have any good reason for thinking that an abscess lay close beneath there could be no possible objection to making an incision into the cerebral substance, as was on one occasion practised with success by Dupuytren in apparently hopeless circumstances.* Cure is then beyond our reach; but perhaps prevention was not. And the latter indication should sufficiently occupy our regard in the previous treatment of the injury.

When a severe scalp wound has been sustained, with bruising or fissure of the bone, it is not uncommon for the character of the wound to degenerate as in the case of dura-matral abscess, with some constitutional disturbance of an unpleasant character. But neither the meningitic symptoms, nor those of compression, appear. Suppuration has taken place in the diploë. If fissure exist—perhaps extending on through the external table—pus will be found oozing outwards. Enlargement of the chink is necessary, however, for more free evacuation. If there have been no previous solution of continuity, and such symptoms be present as to render our diagnosis certain, the trephine may be used for removal of a portion of the external table.

* Bless, *par armes de Guerre*, tom. ii. p. 146.

The mischief may extend inwardly, and dura-matral abscess form, as previously stated ; but, fortunately, such is by no means the invariable result ; and is indeed little likely to take place, if suitable treatment have been adopted.

If phlebitis occur in the diploë, the case becomes eminently serious ; partly on account of the direct effects of this disease giving rise, as it may, to intracranial suppuration ; but mainly from the risk of pyæmia.

After injuries of the head, metastatic abscesses of the lungs, liver, serous cavities, joints, or areolar tissues frequently occur ; and it is probable that at least many of these cases are connected with phlebitis, or with thrombosis of the veins, in the diploë.

Fractures of the Cranium.

In the child, much violence may be sustained by the cranium with impunity. The osseous tissue is then elastic ; it yields to the force, and is temporarily depressed, but without solution of its continuity ; and after a time, the depression is gradually effaced by a vital resilience, independent of external aid. In the adult, and more especially the aged, the bone is of a much more brittle nature ; and while less force succeeds in effecting solution of continuity, more or less extensive, no instance of depression of the skull has ever been known to exist without the occurrence of fracture.

The skull may be merely fissured ; or the injured part is broken into fragments, implicating the whole thickness of the bone, with or without depression of these ; or the external table alone is broken ; or the internal table exclusively suffers ; or both are penetrated by a sharp-pointed weapon, the internal sustaining the greater amount of injury. The fracture may be at any part of the periphery of the vault of the cranium, or may traverse its base ; and, further, it may be either simple or compound. All these forms of injury vary much in their effects ; in themselves, however, they would be of little moment were it not for the important parts contained within, which must always sustain more or less injury along with the bony case in which they are enclosed.

The dangers attendant on the injury are various. 1. By concussion. 2. By extravasation of blood within the cranium. 3. By excessive escape of blood externally from the wound. 4. By displacement of the fractured portions inwards, causing compression. 5. By inflammatory access, occurring in either the brain or its membranes.

The treatment will comprise various indications calculated to oppose these several results.

Fractures of the cranium, whether simple or compound, unite only by definitive callus. In some cases, even long after the fracture, no union whatever has occurred ; and this is probably due to the absence of the provisional callus ; a wise law of exclusion, however, seeing that were such callus present in quantity, it could not fail seriously to interfere with the functions of the brain. Sometimes, however, a marginal formation of new osseous matter along the line of fracture upon the inside of the skull has been observed ; and where the line of fracture has passed

through one of the sinuses, the new bone has sometimes been so considerable as permanently to obstruct its venous channel.

Fissure.

Capillary solution of continuity is, in itself, a thing of but little importance. But the shock which has caused it may well occupy our attentive regard. The fissure itself, indeed, may in its formation have proved an actual advantage ; rendering the concussion less intense and less hazardous than it might have been, had the ringing calvarium remained entire.

The fissure may be short, and bounded by sutures ; or it may traverse several of these, and be of great extent ; as in the instance of the Duke of Orleans, who died from being thrown from his carriage in 1842 ; the whole osseous case was split into two parts. Fissuring may take place at the part struck, or at the site of the *contrecoup*. It may be conjoined or not, with rupture of the dura mater at the fissured part ; and if it be so conjoined, compression by extravasation is likely to ensue. Where the injury is situate at the base of the cranium, it is usually associated with such rupture ; and extravasation occurring at this site, even to a slight extent, we have already seen to be of the gravest import.

The symptoms attendant on fissure are usually those of concussion in the first instance ; and these may be followed by those of compression by extravasation. Inflammatory accession is not unlikely ; giving the ordinary train of symptoms, varying according to the part and texture involved. And these, again, may be merged in the symptoms of compression by suppuration. If the injury be compound, the existence of fissure is ascertained by the finger or probe. If it be simple, the fissure may very probably elude detection ; the case being treated as one of simple concussion.

Long ago, it was the custom, in the treatment of this injury, to expose the fissure throughout its whole extent, by incision ; and to apply the trephine repeatedly in its course ; probably in the hope of liberating extravasated blood. But no one now thinks of thus aggravating what is in itself comparatively simple. It is time enough to take up the trephine when symptoms of compression, by blood or by pus, are so plain and urgent as to demand its use. It is not often, as already explained, that on the first count we are called upon to operate ; and, if we have seen the case from the first, it may be our own fault if we have to interfere on account of any untoward inflammatory result. The treatment is chiefly expectant. We await reaction from the effects of concussion ; watch the period when extravasation is likely to occur ; and, if need be, then interfere—repressingly. That period of danger having passed, we are again quiescent, though alert ; looking out for symptoms of inflammatory accession ; and ready to oppose these with energy, should they appear.

Fissure at the base of the Cranium.

Solution of continuity, in this situation, is usually a fissure ; disruption, more or less extensive, without comminution or displacement.

The fissure may either extend through previously compact bone ; or be a kind of diastasis—separation of the sphenoid from the temporal bones, for example, at the original points of union. As already stated, it is generally accompanied with laceration of the dura mater, and internal hemorrhage ; and consequently is invariably attended with the greatest danger to life. The important parts of the brain implicated are almost certain to be compromised in function, sooner or later ; either almost immediately by laceration and extravasation ; or by inflammatory change at a more remote period.

The injury may be occasioned in various ways. The head may be crushed laterally, or in an antero-posterior direction ; as by the wheel of a vehicle passing over it, or by being jammed between a wheel and a wall or post, or between a fixed surface and machinery in motion. Or, while the body is at rest, a severe blow is received on the vertex ; and the strain of the shock, communicated through the temporal bones, produces a splitting of these, or tears open the connections with the sphenoid.* Or the body, falling, alights on the vertex ; and the spinal column, carrying both the weight and momentum of the body, is driven down upon the cranial base—the basilar process being probably broken through.† Or, falling from a height, the patient alights on his breech, on his heels, or on his knees ; and, again, a concussion sufficient for disruption may be so communicated to the cranial base. In such cases, however, the site of fracture and the line of fissure vary greatly. Sometimes we find the petrous portion of one or both temporal bones alone suffering ; sometimes the fracture is oblique in its direction, involving one temporal and the opposite wing of the sphenoid, and coursing through the body of the sphenoid or the basilar process of the occipital. According to the observations and experiments of Dr. Aran,‡ the situation of the line of fracture of the base, when the force is applied to the vertex, is determined by the part which first sustains the impetus of the fall or blow. When the force acted upon the anterior part of the vertex, the fissure of the base was always, according to that authority, found in the anterior fossa ; when upon the middle of the vertex, in the middle fossa ; when upon the posterior, in the posterior fossa ; and in all these instances the fracture of the base was accompanied by a corresponding fissure of the vault. From this fissuring of the vault, at the seat of the application of the force, the injury of the base is presumed to result ; and it need be no objection to this explanation, that in many of those

* “If a force be applied to the vertex, the superior border of the parietal bones resist displacement downwards, inasmuch as their inferior borders cannot be thrown upwards in consequence of their being supported laterally by the overlapping of the squamous portions of the temporal bones ; while the temporal bones, as M. Malgaigne has pointed out, are themselves supported by the zygoma, which constitutes on each side a true buttress, sustained by the superior maxillary bone. A shock, then, applied to the vertex, is directly transmitted to the temporal bone, and propagated through its petrous portions to the posterior part of the body of the sphenoid bone, the parts which most fractures of the base of the cranium traverse.”—*Brit. and For. Med. Rev.* No. 29, p. 174.

† Sir B. Brodie, *Med. Chirurg. Trans.* xiv. p. 329 ; Hilton, *Lectures on the Cranium*, p. 61.

‡ *Archiv. Gen. de Med.*, 4e ser., tom. vi. p. 180.

injuries the fissure implicates more than one fossa, for in most serious falls upon the vertex it must be obvious that more than one segment must be affected.

In cases of fracture of the base, the extravasation is not always slight; it may be great, one or more of the large venous sinuses having been torn; then the symptoms are from the first most grave, and cannot but end fatally and soon.

The circumstances which lead to a suspicion of fracture at the base of the skull are: The kind of injury inflicted, such as already described symptoms of compression, early and severe; escape of blood from the

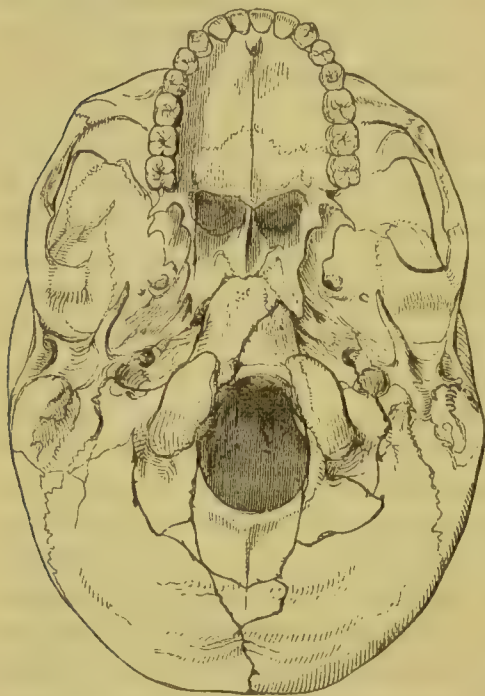


Fig. 235.

ears, nose, mouth; ecchymosis of the eyelids and ocular conjunctiva—the orbital plates having been broken too, and blood infiltrating forwards into the loose areolar tissue—and behind the mastoid process, or in the temporal region amaurosis and paralysis of the face and discharge of a watery fluid from the ear, throat, or nostril: sometimes in considerable abundance. The last symptom—often termed “welling of the ear” when it comes from the *meatus auditorii*—is not immediate, but occurs after some days have elapsed. By soon it is considered to denote escape of serous fluid from the sac of the arachnoid; others, contending that the phenomenon has been known to occur when certainly that sac was

not opened into, believe that the fluid is but the serum of extravasated blood, trickling through the fissure; while others are inclined to believe that in many cases the fluid is either from the fractured surface of bone or is the Liquor Cotunii, or merely a hypersecretion from the cavity of the tympanum; by all it is held as a sign of most untoward import. Bleeding from the nose, mouth, or ear, following on severe injury of the head, is always suspicious; more especially if the patient be found in

* Laugier, *Compte Rendu de l'Acad. de Scien.* 1839, p. 240, *Archives General de Med.* Aout, 1845; also, *Brit. and For. Med. Chir. Rev.* April 1850, p. 342; Rankin *Retrospect*, vol. ii. p. 100; *Lancet*, No. 1558, p. 24.—HILTON.

Stalpartius van der Wiel, *Observ. varior. cent prior obs.* xv.; O'Halloran, *Injury of the Head*, p. 120; Colle's *Lectures*, by M'Coy, vol. i. p. 135; Alber's *Gazette Medical* 1840, p. 811; August Berard and Nelaton, *Compend de Chir. de Paris*, tom. i. p. 542; Robert Chassaignae, *Mem. de la Soc. de Chir. de Paris*, tom. i. p. 562 and p. 542; also Chatin, p. 568.

Fig. 235. Fissure at the base of the skull, involving the occipital and sphenoid bones. The patient fell from a ladder on the vertex, and lay comatose for some days before death. Extensive extravasation was found over the cerebellum and middle lobes of the brain.—LISTON.

state of insensibility. But let it be borne in mind that such a combination of circumstances by no means certainly denotes the existence of fracture at the base; the insensibility may be that of concussion or of intoxication; the bleeding may proceed from mere laceration of the Schneiderian membrane and of the lining of the meatus—or rupture of the membrana tympani—and from injury of the tongue by the teeth. When, however, we have such bleedings accompanied by urgent insensibility, obviously of the nature of coma; when the head symptoms either remain unimproved, or advance untowardly; and, more especially, when by and by the “welling of the ear” appears, and the fluid, by its large proportion of chloride of sodium and very small quantity of albumen, is found to be identical with the cerebro-spinal fluid; and lastly when amaurosis and facial paralysis coexist—we may safely conclude that fracture at the base has occurred.

The treatment must plainly be prophylactic and expectant, as already advised in the case of compression by inaccessible extravasation. There is no room for operative interference, for the parts injured are quite beyond our reach. If the compression be happily got over, we must then be very watchful of inflammatory accession. In all cases, prognosis is unfavourable; the majority prove fatal—either immediately by coma from extravasation, or more remotely from the effects of inflammatory progress. Such cases, however, are by no means necessarily hopeless, even when paralysis accompanies the other lesions. Nor must we deny, as some authorities have been inclined to do, the authenticity of a case of fracture of the base of the skull, for no other and better reason than that recovery has resulted.

It must also be remembered that fissure of the cranial base may occur without any characteristic symptoms being evinced; the patient seeming to labour under mere concussion. The fissure may have been slight; and the solution of continuity may have been confined to the bone alone. The membranes remain entire; and there is no inward escape of blood. Compression, by extravasation, necessarily does not supervene; and inflammatory danger may be warded off by ordinary care. Such cases, however, are of comparatively rare occurrence; more or less laceration of the brain's substance being the common accompaniment, and the great risk, in fracture of the *basis cranii*.

Fracture without Displacement.

The most common solution of continuity in the cranium is not a mere fissure; but a fracture, analogous to comminuted fracture of the long bones; reducing the injured part to the condition of being broken up into one or more fragments; and these, though undoubtedly somewhat displaced at the time of the accident, may or may not remain displaced. When there is no displacement, the dangers to be apprehended are such as are common to other injuries of the head, apparently less severe; concussion; excessive reaction, bringing compression either by extravasation or by acute inflammatory accession; or a more insidious inflammatory process, occurring at a more remote period. The fracture may be simple, compound, or with wound. The compound is necessarily of a more

unfavourable character than the others; danger by inflammatory mischief being greater and more probable. But the difference is, on the whole, not so marked as between corresponding injuries of the bones of the extremities. It is possible that the existence of a communicating wound may prove even an advantage; by permitting outward escape of blood or of inflammatory products, and so saving the important internal parts.

The treatment is prophylactic and expectant, according to the general principles already explained. There is as little necessity for immediate trephining, as in the case of mere fissure. If the injury have been sustained at the lower and anterior angle of the parietal bone, and is speedily followed by urgent compression, it may be advisable to apply the trephine in order to afford a freer vent for the meningeal hemorrhage. But, usually, the aperture already existing is sufficient for an outward drain. And again, should symptoms of compression by suppuration supervene, at a more advanced period, operative interference may be necessary to effect a free evacuation. In general, however, there is no necessity for the use of the trephine.

Fracture with Displacement.

If the fractured portion, or portions, be displaced inwards, the brain is more or less incommoded, and symptoms of compression ensue; proportioned usually to the amount of depression, and to the relative importance of that part of the brain which is injured. The upper and anterior surface of the brain, as formerly stated, may bear a very considerable amount of compression with comparative impunity.

The injury may occur without corresponding wound of the soft parts, the whole vault having sometimes been so smashed within an almost uninjured scalp as to resemble a bag of broken fragments; usually, however, the fracture is compound.

The dangers are formidable. 1. By concussion, bruising, and laceration of the brain. 2. By extravasation of blood. 3. By the results of the inflammatory process on the brain and its membranes. 4. By compression, caused by the displacement.

The three first are to be opposed by fulfilment of the ordinary indications. The last is to be removed by operative interference. But in regard to this the question at once arises:—Whether, in all cases of depressed fracture, operative interference, for the purpose of replacing the depressed portion of bone, is necessarily demanded? Formerly, the answer was in the affirmative; at present, it is not so. Elevation of the depressed portion is had recourse to, with two remedial objects in view: to remove the cause of compression, and consequently the symptoms; this, when they exist; and also to remove a likely exciting cause of inflammatory access from the portion of cerebral tissue and membranes acted upon by the depressed bone. When the symptoms of compression are great and urgent, or, without increasing, shew no tendency to abate after waiting for a moderate period, there is no room for hesitation; it is plain the duty of the surgeon at once to attempt removal of the cause; and fulfilment of the former of the two indications is sufficient warrant for recourse to the operation. But if symptoms of compression either do not exist,

re slight, and are recedent rather than gravescent, the case is very different. If we operate, then, it is only to fulfil the latter indication ; removal of the exciting cause of an apprehended inflammatory process. And then this other question arises :—Whether the continued pressure of a smooth portion of depressed bone, or the further injury inflicted by performance of the operation, is the more likely to excite an untoward amount of this ? Experience has answered to the effect that the greater risk is encountered by recourse to operation.* And, consequently, the rule is, to refrain from operation in all cases of ordinary depressed fracture, in which symptoms of compression do not exist. Further : we know that the brain has the power of slowly recovering under a certain amount of pressure, even when that pressure continues undiminished. And, consequently, the rule of non-interference is extended also to those cases in which the symptoms of compression exist, but are by no means urgent, and seem to be slowly receding rather than on the increase. In young subjects, the call for artificial elevation must be especially urgent before it can with propriety be obeyed. For in them, it is to be remembered, that besides the facility with which the bones of the cranial cavity yield at some other part to accommodate the compressed contents, a system of *mutual accommodation* may be said to be in progress ; the brain not only becoming accustomed to its altered circumstances, but the compressing agent being also gradually withdrawn—the bone, by its inherent elasticity, slowly re-approaching its former level. In the adult, there is not the same resiliency ; but then, too, something is done, on one part of the bone, to favour complete recovery of the functions of the accommodated organ. For after some considerable time, the depressed portion is found to have become wonderfully smooth on its internal surface, and bevelled at its margins, by absorption ; not ceasing to press, but now pressing with all gentleness, on the parts beneath.

In ordinary fracture with displacement, therefore, we do not interfere by operation, unless symptoms of compression not only exist, but persist, or are urgent. And while in these cases the operation may not wholly succeed—the compression being perhaps by blood as well as by bone—still we believe that under such circumstances the operation is not only advisable but imperative. In all other cases, we content ourselves with the expectant and prophylactic treatment, as if depression did not exist.

When the fracture is compound, comminuted, and depressed—that is, when fragments are not only displaced, but completely detached from the rest of the cranium—we of course do not hesitate, in all such cases, to remove the loose fragments, with gentleness and care, whether symptoms of compression exist or not. Yet such is not the doctrine incul-

* Abundance of cases are on record, testifying the power which the brain has in bearing long-continued pressure, with comparative impunity, so far as inflammatory compression is concerned. One very remarkable instance is related by Sir A. Cooper (lectures, p. 128), in which certain symptoms of compression endured for upwards of thirteen months, in consequence of the existence of depressed fracture ; complete and most instant recovery following removal of the depression by operation at the end of that period.

cated by all surgical authorities. Stromeyer,* for instance, recommends, even in gunshot fractures of this kind, that no interference should be permitted, the detachment and separation of depressed portions of bone being left to nature alone. While he undoubtedly speaks from experience, and is backed by the results of similar non-interferences on the part of British surgeons in the Peninsular, Crimean, and Indian campaigns, it seems very unreasonable to leave unremoved fragments which are exposed, detached, and virtually so many sources of irritation, in contact with a membrane prone to inflame, and in which, to check the occurrence of inflammatory accession, we are already commencing to employ our most powerful antiphlogistics.

Let it be understood, then, that when, in a case of compound fracture, with displacement, sharp fragments seem to be dangerously in contact with the dura mater—much more, if this membrane be penetrated or punctured by them—we ought as soon as possible to raise or remove the offending portions, whether head symptoms exist or not; for in no other way can violent inflammatory accession be averted.

When operative interference is determined on, the indications to be fulfilled are sufficiently plain. To expose the parts, by suitable incision of the soft textures superimposed. To use the sound margin of bone as a fulcrum, on which the elevating lever may rest. To insinuate the extremity of the lever beneath the displaced part, and to effect replacement with as little violence as possible. For the insertion and working of the elevator, sufficient space may already exist. If not, this is to be acquired; by gently lifting away a loose fragment; or by removing a portion of the sound bone, by means either of the saw, the bone forceps or the trephine. After the operation, much antiphlogistic care must necessarily be maintained.

Punctured Fracture.

By the term “ordinary fracture, with or without displacement,” is meant injury done by an obtuse body; causing solution of continuity throughout the whole thickness of the bone; and producing fragments composed of both tables of the skull, separated from their general connection in nearly equal proportions. A smooth, uniform, non-penetrating surface is consequently presented by the depressed portion to the brain and its membranes. But when a sharp-pointed body—as the point of a poker or pitchfork, the corner of a spade, shovel, or hammer, or the angle of a sharp stone or slate—impinges on and penetrates the cranium, the nature of the injury is very different. The external table is usually crushed by the penetrating body, to an extent proportioned to its lodgment. But the inner table gives way to a greater extent. This used formerly to be explained by the greater brittleness of the internal table of the skull; experimental inquiry, however, and examination of museum specimens—where, from the nature of the injury, the penetrating body has again made its exit from the cranial cavity

* Stromeyer, *Maximen der Kreigsheilkunst*, Hanover, 1855; also *Brit. and For. Med. Chir. Review*, January 1856; Ballingall, *Military Surgery*; Williamson, *Notes on the Wounded from the Mutiny in India*, London, 1859.

in some gunshot wounds, prove that these characters become reversed ; that it is more the direction of the force, and degree of support afforded in passing through the bone, which determine the comparative extent of fracture of the outer and inner tables of the skull.* Besides the greater extent of surface of the inner table which is thus separated from surrounding vascular connection, it is very often found to be further broken up into fragments—usually small and spiculated—which, being driven inwards by the force of the blow, penetrate, or at least seriously irritate, the coverings of the brain, producing inflammatory accession. This may be general, involving the brain itself, and to the last degree dangerous ; or it may be limited to the injured dura mater, causing abscess there—a result still most perilous to life. And to accomplish the latter evil, it is not necessary that the fragments of the inner table should penetrate, or in any way mechanically injure the dura mater. It is sufficient that they are detached from the general cranium, and remain unremoved ; there they necessarily die ; and, as sequestra, they inevitably become surrounded by purulent formation.

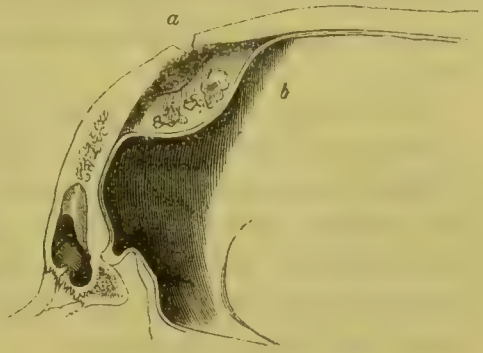


Fig. 236.

The rule of practice, then, comes to be plain. Whenever we are satisfied that punctured fracture has occurred—in other words, that the kind of fracture is such that splintering of the internal table is certain—we cannot too soon proceed to operation. We trephine immediately, so as to expose the fragments, and admit of their being carefully and efficiently removed. Unless they are taken away, antiphlogistics are practised in vain ; the inflammatory process becomes established at the part ; sooner or later abscess forms ; and then we find ourselves compelled to operate for the removal of the separated fragments, or for the relief of compressed brain, under very unfavourable circumstances. The best result is abscess of the dura mater. But it may be, that even the questionable chance by operation is not afforded ; the inflammatory attack having proved general—cerebral, as well as meningitic—and speedily carrying off the patient. Taking the most hopeful view of the case, a necessity for operation is certain to arise, at some stage. And surely it is most prudent to operate at that time which plainly is most promising of an auspicious result. Better to operate at once, removing the paramount exciting cause of the inflammatory process, and probably averting all casualties ; than to attempt, subsequently, to retrieve or limit danger and disaster, already sustained.

The rule as to operation, then, is very different in the case of punctured fracture, from what is applicable to any other injury, hitherto considered. We at once proceed to the operation of trephining, whether

* Erichsen's Science and Art of Surgery. Williamson, *ut sup.*, p. 17. Prep. Museum at Chatham, No. 2881.

Fig. 236. Punctured fracture, at *a* ; at *b*, the dura mater represented detached, and spicula of bone lodged in the vacant space.

head symptoms are present or not. The mere existence of this form of injury is an amply sufficient warrant for our interference. Head symptoms, and those of a most urgent kind, are certain to supervene, if the operation be withheld; and they can be averted only by early removal of the splintered fragments resting on the dura mater. After the operation, antiphlogistic treatment must be sedulously maintained.

As in the case of concussion, it may be difficult, at first, to persuade the patient—as yet suffering but little—of the propriety of instantly submitting to treatment which may seem to him unnecessarily severe, and indeed quite unwarrantable. This obstacle is to be overcome, by a calm yet earnest exposition of the certain danger which otherwise awaits him.

Obviously, it is our first duty to come to a just conclusion as to the existence or not of this kind of fracture. A most minute examination is accordingly made. The scalp is freely divided, if need be, to expose the fractured point to sight as well as touch; and by a gentle yet determined use of the finger and probe, we endeavour to satisfy ourselves thoroughly; assisted in our decision by regard to the mode in which the injury has been inflicted.

Penetrating cuts of the Cranium—as by a sabre, axe, or sharp spade—often closely resemble punctured fracture, as to the kind of injury done to the inner table, and the immediate necessity for operation. When the cut passes sheer through both tables, the inner one is usually splintered; and the fragments press inwards, untowardly. They must be removed. The chasm of the wound is often sufficient to disclose their presence and site, to finger or probe; and it may suffice for removal also. If not, room is to be made by application of the trephine, or saw, as may seem most convenient.

Fracture of the External Table, alone.

This is not an uncommon result of comparatively slight violence done to the calvarium; by bodies either sharp or obtuse. The external table alone gives way; and is perhaps driven inwards on the diploe. The most marked sample of the injury is afforded by fracture over the frontal sinus; in other parts of the calvarium the accident occurs only in those of middle age, who possess diploë, with marked distinction between the cranial plates. No operative interference is required except in the case of the frontal sinus; and then elevation of the depressed part is expedient. The treatment is, locally and generally, antiphlogistic. But, as formerly stated, the inflammatory process may become excessive, and extend inwards; and suppuration in the diploe may lead to suppuration also on the internal aspect of the bone, necrosis of the implicated part ensuing. Under such circumstances, the operation of trephining is likely to be required, to relieve compression. Sometimes diploal phlebitis, or thrombosis of the intracranial sinus with the usual sad consequences, ensues; too often baffling all treatment.

Fracture of the Inner Table, alone.

Fortunately this is of comparatively rare occurrence ; for, the outer table remaining entire, we have no means of ascertaining the nature of the injury, at the time of infliction. It may follow on a sharp concussing blow ; in a patient, who, by reason of age or other cause, has a vitreous table of unusual brittleness. The table may be simply severed, and not much depressed ; then head symptoms are likely to prove both slight and transient. But, more probably, there is comminution as well as displacement ; and then the usual hazard is incurred from the depressed and perhaps penetrating spicula. The trephine is likely to be called for, after a time, on account of dura-matral abscess.

Depression without Fracture.

As already stated, this occurs only in children ; in whom bones are more prone to bend than to break. A dimple is made in the skull by external violence, and is slowly effaced by virtue of the inherent elasticity of the tissue. For a time, there may be symptoms of compression ; but seldom of a marked character ; and still more rarely urgent. Operative interference is neither necessary nor expedient. The treatment is simply antiphlogistic ; and prophylaxis is long maintained.

The Operation of Trephining.

The trephine is a circular saw, worked by a light and rapid movement of the hand, whereby a portion of the skull is divided, and may be removed. The older surgeons employed what is known as the trepan ; an instrument of much greater power, and which seems to have fallen into disuse most unjustly, as it is adapted to economise muscular effort. In it the saw is fitted upon a pivoted shank, precisely like the carpenter's brace, and is worked in like manner. A less cumbrous instrument, upon the same principle, has more recently been copied from the armamentarium of the engineer, in which the saw, pivoted upon a shank, and provided with a horizontal but marginally-bevelled ratchet wheel, is driven by a perpendicular pinion wheel fitted to a rectangular driving handle. For the application of the trephine or trepan, complete exposure of the bone is necessary. If a wound already exist, it is enlarged to the necessary extent. If there be no previous wound, a crucial or other incision is made ; so that, by reflection of flaps, the required exposure may be effected. The pericranium is carefully raised to an extent sufficient to admit of the free play of the instrument ; but no further. The centre-pin, sharp-pointed, having been made to protrude a short way beyond the serrated edge, is securely fixed there by its screw. And then, by firm pressure, accompanied with a slight rotatory motion, the centre-pin is fixed in the bone, so as to steady the teeth of the instrument as they cut into the external table. The teeth of the trephine are usually set so as to work from left to right. The turnings are made steadily and rapidly ; with very light pressure, after the centre-pin has been fixed ; and the light pressure is exerted only during the movement from left to

right. When the sulcus has advanced to such a depth as is sufficient to retain the saw steady in the groove, the instrument is withdrawn, and the centre-pin pushed back entirely; to proceed with it still protruding, were not only to do what is unnecessary, but also to encounter much risk of injury to the dura mater at the latter part of the operation. The plain crown is reapplied, and worked steadily as before. There is no occasion for hurry; the operation itself, so far as the sawing of the bone is concerned, is comparatively painless; besides, it is usually undertaken while the patient is insensible; and in those cases where sensibility remains, experience has shewn that anæsthesia by chloroform may be practised with perfect safety. If diploë exist, a change of sound and feeling is imparted to the operator, intimating that the saw has passed the external table. Then the instrument is worked very warily; and it is well to remove it from time to time, examining the sulcus with a probe or toothpick, to ascertain whether or not at any point section of the inner table may have been completed. If an aperture be detected,

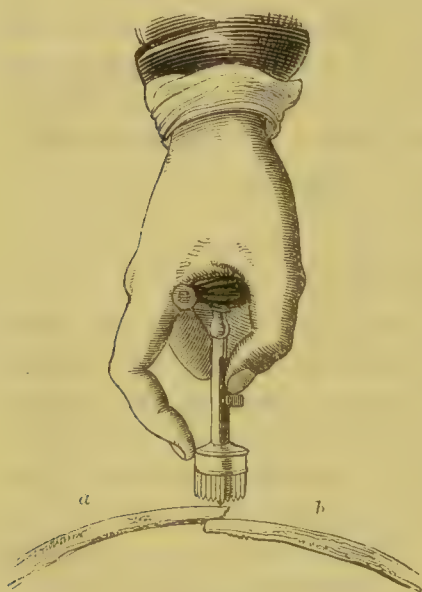


Fig. 237.

then the instrument, when reapplied, is inclined to the opposite side, and moved with increased caution and lightness. Want of parallelism in the two tables of the skull renders such precautions essential to a safe performance of the operation. Section having been completed at all points, the detached circle is to be removed. Perhaps it may come away in the crown of the instrument. If no dislodgment is effected by the point, a lever, or by forceps; and the circle gently withdrawn:—in this step of the procedure, as well as in the last of the sawing, much care being taken to avoid injury to the dura mater. If any rough or sharp points are found on the margin of the aperture, these are to be removed by the elevator, or the “*lenticular*,” an instrument fitted into most trephine cases, and suited for this purpose; otherwise, the dura mater might sustain injury.

When the operation is undertaken for elevation of depressed bone, it is seldom necessary to remove an entire circle. All that we desire is room sufficient for raising the depressed portion, and removing fragments if need be; and this can usually be accomplished by fixing the centre-pin on the brink of the sound bone, and so removing by the saw only a segment of the circle. While, again, in many cases, all the bone which is required to be removed, can be cut away by means of bone-cutting forceps or a small saw.

The operation, and the object for which it was undertaken, having been accomplished, the flaps are carefully replaced, and the general wound is invested by tepid water-dressing; care being taken that

Fig. 237. Trephining. *a*, the sound portion of cranium; *b*, the depressed. centre-pin fastened on the brink of the sound portion.

undue bleeding takes place from the scalp ; and, in regard to this point, it is to be remembered that vessels which do not bleed during the state of depression, may part with their contents freely on the establishment of reaction. Above the water-dressing it is well to place a few turns of a bandage, lightly applied, so as to afford support ; and this is more especially necessary when deficiency of the cranium happens to be considerable. The wound, in other respects, is treated in the ordinary way ; union taking place by the second intention. Of course, rest is absolute, severity of regimen is extreme, and antiphlogistics are held in readiness, for some considerable time after the operation. It has been proposed to replace the removed circle of bone, after completion of our object, in the hope of its becoming reunited ; but such hope has been proved vain, as might have been expected.

When the wound has healed, the dura mater is found to have become incorporated with the soft parts exteriorly ; and the breach in the cranium is not filled up by bone, but by dense membranous formation. A meagre film of new bone may be found at the mere margin of the aperture. And this, in time, extends centripetally ; apparently by the slow secretive action of the parent bone alone, the pericranium, dura mater, and other soft parts, seeming to be incapable of ossific action. At the margin of the aperture the new bone may ultimately be of similar thickness with the cranium ; but as it extends, it shelves rapidly ; becoming very thin as it approaches the centre. Many years are required, ere osseous reparation is complete. And in consequence, it is expedient for a long time to guard the imperfect part from external injury ; a piece of leather or metal being worn over the cicatrix.

At one time, trephining was frequently performed ; and on grounds much too slight. From the preceding remarks, the following brief deductions may be drawn, as to its present use. It is had recourse to, 1. On account of punctured fracture, as soon as possible ; whether head symptoms exist or not ; the object being to remove splintered fragments of the inner table. 2. On account of depressed fracture, accompanied with urgent symptoms of compression ; when elevation of the depressed portion cannot otherwise be effected. 3. On account of dura-matral abscess, when local and constitutional symptoms sufficiently concur in pointing out the existence and site of this morbid condition ; the object being to effect external evacuation of the pus. 4. On account of urgent compression caused by extravasated blood ; only when the circumstances are such as to indicate the seat of extravasation, and when that happens to be accessible.

Occasionally the surgeon has been called upon to trephine, in cases of epilepsy, in which the disease seemed to be connected—in the relation of effect and cause—with a depression of the cranium, the result of former injury ; or in which circumstances seemed to point with much plainness to a certain spot of the cranium—perhaps the seat of internal enlargement, of either a globose or spiculated character. The operation, under such circumstances, is of doubtful expediency ; but may be performed, at the suspected spot, in obedience to the urgent entreaty of the patient or his friends.

Trephining has also proved successful on account of neuralgia dependent on inward growth from the cranium.*

In general, it is well to avoid applying the trephine in the direct course of the middle meningeal artery, or over the longitudinal sinus. Yet if it seem of decided importance that the instrument should be applied at such localities, the risk of hemorrhage need not deter us. A compress of lint, directly and accurately applied, will readily restrain the venous bleeding; and if a similar application fail to stanch the arterial flow, the osseous canal, in which the vessel is usually imbedded, may be temporarily plugged, by the insertion of a small portion of wood or cork.

Wounds of the Brain.

The brain may sustain an incised wound, as by a sabre cut; a contused and lacerated wound, as by depressed fracture; a punctured wound, as by the thrust of a bayonet, pike, or any other sharp-pointed weapon; or a gunshot wound—of the class “contused and lacerated,”—by the penetration of a bullet. The likelihood of disaster is grave and imminent; by extravasation of blood, in the first instance; by inflammatory accession and its results secondarily. Treatment requires to be proportionally watchful and energetic.

Incised wounds may simply penetrate, or partially detach a slice of the organ. Such a flap is not to be at once removed; but should be replaced, along with the corresponding investing textures, in the hope that reunion may occur. Examples are not wanting of a fortunate result.†

In contused and lacerated wounds, a certain amount of inflammatory access is inevitable. It is our business to moderate and control this, by the ordinary means; so preventing disorganization and protrusion of the cerebral tissue at the injured part.

In punctured wounds, inflammatory accession is not inevitable—unless foreign matter lodge; yet it is very likely to occur. The antiphlogistic precautions require to be very rigid.

In gunshot wounds, danger by inflammatory accession is pre-eminently great. Not only is the wound of the contused and lacerated kind; there is also great probability of lodgment of the bullet, or portions of it, especially if it be a round ball and discharged from a musket; for with the present rifled arm and the conical ball, it is rare indeed for any lodgment to be effected, the ball usually perforating the skull, with an amount of injury which recent experience has shewn to be uniformly fatal. Along with the missile, portions of the patient's cap, scalp, hair, and skull, are usually carried along its track and lodge there. But lodgment, it is well to recollect, of extraneous materials, may be effected without the appearance of any sufficient aperture of entrance. A fragment of a ball, cut off from the general mass, may pass through a fissure which temporarily opens to give it entrance, and again rises to its former level. One such case came under the writer's notice, where a small tuft of hair projecting from fissure of the skull which could hardly otherwise be detected, ind

* Boston Med. and Surg. Journal, August 1846, p. 53.

† LARREY, Clinique Chirurgicale. tom. i. p. 140.

icated the entrance of a fragment of a ball hardly larger than an ordinary leaden pellet, but which had given rise to intracranial suppuration. The mere smallness of aperture in the cranium must not be regarded as a sure proof that the bullet has not lodged; for, in the young more especially, the inherent elasticity of the osseous tissue may be so great as to diminish the space of entrance-wound very considerably. They may lodge external to the membranes, or wound the brain. In either case, they may lie close to the aperture of entrance, or they may become arrested at some distance from that point. The mere fact that a foreign body has penetrated to some distance from the opening in the skull, will not always serve to indicate that perforation of the dura mater has occurred. Larrey, for example, narrates two instances in which balls had passed to some distance from the seat of fracture, coursing along inside the cranial vault, and separating the dura mater from the bone; which separation he, by exploration, traced to the opposite diameter of the cranial circle.* The contusion and laceration of the cerebral tissue and its investments, consequent on gunshot wounds, render a certain amount of inflammatory accession inevitable; and the lodgment of foreign matter determines the amount and intensity of this to be great and hazardous. Further; foreign substances, penetrating deeply, are not unlikely to interfere with those portions of the organ most important to life—at its lower and posterior part; producing death, either instantly, or at no protracted period, by direct interference with function. To this allusion will again be made, in speaking of wounds of the orbit, implicating the base of the brain.

Lodgment of Foreign Bodies.

When foreign bodies penetrate the cranium where the site of lodgment can be ascertained through the wound, the surgeon naturally becomes desirous of effecting removal of so palpable an exciting cause of the inflammatory process—the results of which he so much dreads, and not without good cause. If they can be felt by the finger used gently as a probe, extraction may be effected easily in most cases by forceps, or scoop, with little additional injury being inflicted on the cerebral tissue. In such circumstances, the operation should certainly be attempted with as little delay as possible. If, however, the site of lodgment is unknown, if the foreign body, of no great size, is found both difficult of access and firmly imbedded, or, still more, if the search for it must imply a random poking with a probe through the substance of the brain, it is better to abstain from the infliction of exploratory and evulsive violence; which would be certain to kindle an amount of inflammatory accession quite uncontrollable. It is better to withhold all direct interference; contenting ourselves with antiphlogistic measures, to meet that amount of the inflammatory process—perhaps amenable to control—which the infliction of the wound and the lodgment of foreign matter cannot fail to induce. We may happily succeed; though the general prognosis is doubtless unfavourable. There are instances on record of bullets, lodged deeply in the brain, remaining there harmless for years;

* LARREY, Clinique Chirurgicale, tom. i. p. 215-16.

increased in adventitious cysts—as happens in other textures. Such fortunate patients, however, require ever to be most careful in avoiding all inordinate excitement of the cerebral functions, and of the general circulation; for it has happened, again and again, that—after years of immunity—a debauch or violent emotion has induced a sudden and fatal coma.

The rule of practice then is: That, while it is very desirable, at as early a period as possible, to remove foreign substances which have lodged in the brain, in order that we may hope to contend more successfully with the coming inflammatory process—such removal is not to be attempted at the expense of further and serious injury to the cerebral tissue. Such additional injury will render the inflammatory process uncontrollable; and the patient must perish thereby. Leave the part undisturbed, and trust to general antiphlogistics; for it is possible that the inflammatory process may be kept within moderate limits, and the patient saved. Sometimes they make wonderful escapes; as in the instance of recovery after an iron bar had completely traversed a large portion of the brain.* When, however, the foreign body has made a transit within the cranium between the dura mater and the bone, as occurred in the experience of Baron Larrey, and when both the sensations of the patient, and the prudent employment of carefully conducted instrumental exploration, indicate, without the risk of doubt, the site of the foreign body; then undoubtedly, either by the use of forceps, or by trephining over the site of lodgment, the foreign body may readily enough be removed. The writer has assisted in removing a ball from the left hemisphere of the brain, where it had been lodged for more than a month, and where the external wound gave no indication of space sufficient for the passage of a bullet. The operation was undertaken to afford a free egress for pus oozing from the aperture in the cranium; and on removing a circle of bone, including the fracture, a wound of the dura mater was exposed through which a pultaceous mixture of pus and brain substance oozed coming from a cavity in the hemisphere, in which lay the bullet, and from which it was extracted without difficulty.

Hernia Cerebri.

By this term is meant protrusion of the cerebral substance through cranial deficiency. To constitute this morbid state, three things usually conspire: deficient space in the cranium; a corresponding aperture in the membranes of the brain, by wound, ulceration, or sloughing; and disorganization of the corresponding portion of cerebral substance by inflammatory change. It is most likely to follow on compound and comminuted fractures of the skull, with depression of the fragments, and laceration of both brain and membranes. The protruding prominence of brain at first merely fills the cranial orifice; it then shoots above it; and, in no long time, it may attain to a considerable size. Now, probably, its neck becomes impacted in the cranial aperture, is strangulated there, and it sloughs; a fresh protrusion, however, takes place, and the progress is as before. Portion after portion of the upper part of the brain may be lost.

* Bigelow; Brit. and For. Rev., Oct. 1850, p. 543.

in this manner, without apparent and direct injury to the cerebral functions;* but, sooner or later, the formidable constitutional irritation which accompanies will prove fatal; and there is besides a risk of the inflammatory process extending widely from the original site, and proving fatal by affecting important parts at the base of the cranium.

Prevention may be in our power. When the brain has been exposed by compound and comminuted fracture, and when there is a deficiency of the cranium, by removal of the fragments, with or without use of the trephine—the occurrence of cerebral protrusion, in consequence of inflammatory accession, is always to be apprehended. Therefore—1. No more of the cranial walls should be removed than is absolutely necessary. 2. All sharp margins or spicula protruding towards the dura mater must be removed. 3. All injury of the dura mater must be most carefully avoided. And two indications fall to be fulfilled. 1. To atone for the cranial deficiency, by affording uniform, steady, yet gentle support to the part, by compress and bandage; renewing the dressing as often as cleanliness and propriety of management require. 2. By antiphlogistics, timely and efficient, to prevent or control inflammatory accession.

An attempt to *cure* comprises greater difficulty. The obvious indications are, to restrain the inflammatory process; and to repress the exuberant growth. The former is to be fulfilled by antiphlogistic treatment; but this must be most warily conducted, inasmuch as by this time there is no tolerance in the system of severe remedies of that character. To fulfil the second, three means have been considered effectual; pressure, ablation, escharotics. Pressure used to be preferred; and if employed at all, should be direct, accurate, steady, firm, but not severe—lest symptoms of compressed brain be induced, with aggravation of the inflammatory risk. Ablation of the cerebral protrusion is not expedient at first, and should only be resorted to when the protrusion is considerable, and when we hope to relieve tension by affording escape to the inflammatory products which have collected within, and are retained by the protrusion acting like a plug. In such circumstances, the protruding portion should be shaved smoothly off, by a knife, on a level with the cranial aperture.

The protrusion, when examined, will be found to consist of cerebral substance more or less disorganized; often mixed with grumous blood, and other inflammatory products. Sometimes it contains, or is based on, an accumulation of pus, or other inflammatory result. Then enlargement of the opening in the dura mater, or even in the brain substance, may perhaps be found useful, as a means towards alleviation, if not of cure. It must be recollected, however, that this is not intended to encourage any foolhardy exploratory incisions, or punctures; for in many cases the protrusion is obviously due, not to an abscess within the membranes, but to accumulation of serum taking place within the ventricles, and thus displacing the brain substance which lies nearest the opening in the cranial parietes. The formation of a Hernia Cerebri is always a most unfavourable sign; and the ultimate issue is seldom but unfor-

* It has been supposed that the lost portions of cerebral substance are regenerated by a reparative effort on the part of the brain; and that thus the non-impairment of cerebral function may be accounted for.—Lancet, No. 1399, p. 760.

tunate. The affection is sometimes simulated, however, by coagulum. A mass of clotted blood, mixed with inflammatory products, but containing little or no cerebral substance, may protrude; presenting almost the same appearances as the genuine tumour. This is amenable to more summary treatment, and bespeaks a more hopeful issue—although usually a sign of an active inflammatory process having seized on the part, and calling for a proportionate activity in antiphlogistics. The projection is at once removed, by knife or fingers; and support by pressure is applied to the cranial aperture.

Paracentesis Capitis.

The operation of tapping the brain in chronic hydrocephalus, known to Hippocrates, and practised by the surgeons of the middle ages,* enjoys in the present day no great repute. Of modern practitioners, Dr. Conquest has shewn the greatest favour to the procedure; and his experience of it has been by far the most productive of success.† Of nineteen cases in which the operation was performed, ten were “living when last heard of.”‡

Dr. West has collected, from various sources, fifty-six cases;§ of which forty died, sixteen only recovering. Of the fatal cases, six died within four days; six within fourteen days; three within one month; nine within three months; only one survived the puncture six months; and none survived the last puncture more than thirty-five days. Death took place either by exhaustion, or under cerebral symptoms. In many cases, in addition to the presence of much fluid, the substance of the brain was found softened; and, besides, “there existed in sixteen of the cases serious organic disease, or malformation, of the brain itself.”

The serous accumulation usually takes place within the ventricles; and the brain, if not congenitally deficient, is spread out and attenuated, with its convolutions smoothed away; the ventricles ultimately constituting one large cavity covered by a thin layer of cerebral substance, which lies immediately beneath its own membranes. Sometimes, on the other hand—though comparatively rarely—the liquid is immediately within the dura mater; and the brain, which in these cases is usually partially deficient in its commissures, lies at the bottom of the serous cavity. In the former class of cases, the communication between the ventricular serous cavity and the external arachnoid will be found occluded, by inflammatory, syphilitic, or scrofulous product occurring in the membranes. The ventricular cavity thus becomes converted into a closed cyst, and increases in size at the expense of the brain substance by which it is enclosed.

Remedial means in chronic hydrocephalus consist of alterative purgatives, with mercurials, and iodide of potassium, assisted by gentle counter-

* Philosoph. Transact. vol. xlvii. Ann. 1751.

† Medical Gazette, March 1838.

‡ In Dr. Conquest's cases, the greatest quantity of fluid drawn off at one time was $\mathfrak{z}20\frac{1}{2}$; the largest total quantity $\mathfrak{z}57$, or $\mathfrak{z}58$; the greatest number of operations in any one case, five; performed at intervals of from two to six weeks.

§ Medical Gazette, April 15, 1842.

irritation and uniform pressure on the head. These may be expected to be attended with comparatively satisfactory results, when the disease is apparently due to a syphilitic taint, in either of the parents, having been communicated to the unfortunate child. Failing these, the question arises whether the patient is to be abandoned to his fate, or an attempt made to save him by tapping. Some, acting on the principle "*uniceps remedium melius quam nullum*" operate; the majority decline interference. Statistics, in the aggregate, as we have seen, hold out no flattering prospect of success. At the same time, in an otherwise hopeless case, if the parents, on a fair and full representation of every circumstance having been made to them, are willing and desirous to undertake the risk, there seems to be no insuperable reason against the operation being then performed. One of three events may occur; death may ensue speedily; or matters may be left much as they were, the head refilling; or a cure may be effected. Hoping for the last, the surgeon proceeds thus:—

A small trocar is introduced perpendicularly through the bregma, or in the coronal suture, at a safe distance from the longitudinal sinus and its feeding veins; and it is seldom necessary to penetrate further than about two inches. Withdrawing the trocar, clear serum flows through the canula, and the more gradually it escapes the better; compensating pressure being at the same time made on the head, by the hands of an assistant. Should the pulse become quick, the pupils contract, and the face suddenly change its expression, the flow is stopped for a time. Faintness occurring, the child is laid horizontal, and a few drops of ammonia given in water. Sometimes blood comes through the canula, a sign that a vein has been punctured;* sometimes the flow becomes obstructed by a portion of brain, and the canula requires to be cleared by a probe.

After enough has been drained away, the wound is shut by means of collodion, and the whole head is carefully and uniformly supported by elastic strapping. Should slight cerebral excitement follow, it is well; for success is most probable in such cases; a healthful result being induced by the excitement, as after injection of hydrocele. But in general, mild doses of the hydrargyrum c. cretâ are useful, as a check against excess. And when this does occur, our main reliance will be placed on mercurial influence, with topical depletion by leeches.

In the most favourable cases, we can scarcely expect a successful issue but by repetition of the tapping; and the amount of interval must be regulated by circumstances. In but one case have I ventured to operate. The first tapping proved highly satisfactory; the second terminated fatally by convulsions. It has more recently been proposed to inject tincture of iodine into the cavity after the operation of simple withdrawal of the fluid; in imitation of the successful results which have followed a like treatment, in cases of the analogous disease of hydrocephalus. The conditions are, however, so different, that putting together out of sight the consideration of the direct irritation and inflammatory danger to the brain membranes, and only looking at the effects of rapid re-effusion, which we know constantly follows upon the injection of tincture of iodine, such treatment appears quite inadmis-

* Watson's Lectures, Medical Gazette, March 1841.

sible in this situation. Should any operative proceeding be deemed justifiable, it appears not improbable that the introduction of a fine tenotomy knife into the serous sac, with the object of dividing, from within outwards, the membranes and thin layer of cerebral substance which are alone interposed between the cavity of the cyst and the external arachnoid, would so restore the balance which has been destroyed by the occlusion of the cerebro-spinal canal, as to admit of the employment of medicinal agencies with better results than before.

CHAPTER XXXII.

DISEASES OF THE SCALP AND CRANIUM.

Erysipelas of the Scalp.

THIS disease may be idiopathic ; and then it is usually of a mild character, so far as intensity of the local affection, and its effect on texture, are concerned. It is very apt, however, to supervene on wounds ; more especially if the textures have been much bruised, the parts rendered tense, and the inflammatory products prevented from escaping, whether by an improper use of sutures, or by the form of injury originally inflicted. Such untoward accession to scalp wounds is also much favoured by ungenial conditions of the atmosphere at certain seasons ; as well as by previous derangement of the primæ viæ, or habits of intemperance on the part of the patient. If the phlegmonous form occur, danger to texture is great ; by diffuse infiltration both above and beneath the tendinous expansion of the occipito-frontalis ; and the constitutional symptoms are proportionally urgent.

The chief peculiarities of erysipelas of the scalp, in a practical point of view, may be considered to be ;—the unfavourable nature of the parts for suitable treatment of the milder examples, on account of the presence of hair ; the unfavourable nature of the parts, on account of the presence of a large amount of tendinous expansion, for safe progress of the more grave forms of the disease ; the consequent frequency of sloughing of the areolar tissue of the scalp, along with the occipito-frontalis muscle and pericranium ; and the dangerous propinquity of the affected part to an organ of the greatest importance, which is ever liable to suffer. When this occurs, it may usually be traced to an extension of the inflammatory process along the sinuses of the diploë to the intracranial vessels, and from them to the membranes of the brain ; attended with the formation of more or less serous and fibrinous product, and even advancing to suppuration within the cranium. This untoward result, too, may develop itself, when convalescence is apparently already established.

Treatment.—When erysipelas threatens to seize upon the scalp, either directly or by extension from the face, it is our first duty to have clean abrasion of the hair effected, so that the necessary measures may be fully in our power when the accession does occur. In the case of extension from the face, the disease is usually of the simple character and limited to the skin. For cure, hot fomentations, with or without punctures, usually suffice, in addition to the ordinary constitutional management. Cold, or other repellents, must never be employed ; they may be grateful to the sensations of the patient, at the time ; but the risk by meta-

stasis is overwhelming. Even the direct application of nitrate of silver to the erysipelatous part is not advisable ; for a similar reason. In many cases the simple dusting of violet powder over the surface, so as to provide a protective layer—or the application of glycerine to the red and tender skin—will be found more pleasant to the patient, and quite as efficacious as any more potent local measures. Punctures by means of the lancet are more painful than beneficial, and though at one time much employed in such circumstances, may very reasonably be omitted in all simple cases. Especial regard must be had to the interior of the head both during the progress of the disease, and for some days after its apparent decline. Throughout the treatment the head is kept high the patient being almost in a sitting posture.

The chalybeate treatment is not contra-indicated ; but must be conducted with special regard to the risk of cerebral disorder ; and as in such cases the liver and kidneys are usually either singly or together implicated in the disordered state of the system, saline purgatives, with blue pill, antimonials, and acetate of potash, may with great advantage be combined with the employment of the salts of iron.

If the phlegmonous form declare itself in the scalp, and dangerous infiltration have already begun, we cannot too soon make the requisite incisions in those parts which plainly demand them. The knife need not pass beyond the sub-integumental adipose tissue, if the disease has as yet, gone no deeper ; but if infiltration be already subtendinous, the knife must pierce tendon too ; otherwise the invariably aggravating tension cannot be relieved ; pain will increase greatly, and the inflammatory fever will rise higher ; matter will burrow rapidly over the pericranium and probably beneath it also ; and the disease will extend widely—perhaps involving the cranial contents, in at least a minor form. Timely incision will usually check the further progress of the disease, and prevent the extensive sloughing which would otherwise of necessity occur. Should the affection, however, have extended far and wide, then numerous limited incisions should be preferred to one large cut, and these should not be confined merely to the parts where suppuration beneath the bagging scalp already exists, but be placed also in the tumid and brawny parts around, where the preliminary inflammatory process is yet only extending.

When burrowing of matter has taken place beneath the tendinous expansion, it is not necessary to lay the track open throughout its whole extent ; but only, by the formation of a dependent opening—with a suitable counter-opening, if need be—to prevent purulent accumulation, and to afford the parts an opportunity of effecting reunion by granulation. To assist in this indication, uniform support by bandaging is very useful after the acute stage has passed by.

When the scalp has been undermined by pus, even extensively, it does not follow that it must necessarily slough, in any part of the undermined portion. Its vascular supply is not so dependent on the subjacent areolar tissue as is that of ordinary integument ; the course of the ramifications of the occipital and temporal arteries being rather cutaneous than subcutaneous ; and the isolated skin—bearing its own vessel—consequently retaining its supply of blood but little impaired.

Aware of the dangers of erysipelas of the scalp, it is plainly our duty in the management of all wounds of the head—however trivial they may at first seem to be—to avoid everything, in part and system, calculated to induce an undue amount and kind of the inflammatory process; more especially if, by previous indisposition, or sinister atmospheric influence, the patient seems to be predisposed to erysipelatous accession. And even when convalescence is already set in, we should not regard the patient as free from danger of the occurrence of internal mischief. The continuance of a quick pulse, or an unnaturally slow one, a dry tongue, an irritable stomach, and restless or delirious nights, should awaken our suspicions, and demand the employment of active treatment.

Tumours of the Scalp.

Encysted tumours, commonly called Wens, are found more frequently on the scalp than in any other situation; and they are seldom single; occurring in groups, in successive crops, and in various stages of development; varying from the size of a millet seed to that of a small melon, and sometimes in such numbers as almost to defy enumeration. In general they are regarded mainly as deformities; but when they suppurate and open, they may become both troublesome and dangerous. The only advisable mode of treatment is removal by the knife. The main danger to be encountered is inflammatory accession, assuming the erysipelatous character; and this must accordingly be provided against by careful apposition of the edges of the incision; taking care that all bleeding has become spontaneously arrested in the first instance; and suitable constitutional treatment being maintained, as well before as after the operation.

If the tumour be of large size, it is removed by regular dissection. By two elliptical incisions, of merely subcutaneous depth, the redundant and adherent, or ulcerated integument is detached; and then the cyst, carefully preserved entire and tense, is dissected from its connections, and taken away along with the portion of sacrificed integument. The flaps of skin are then replaced; and, on oozing of blood having ceased, they are brought into accurate contact; the wound being treated with the hope of adhesion. Approximation is effected by wire sutures, or a pad and bandage, as seems most suitable; and to facilitate the application of these retentive means, the surrounding scalp should be shaved, if not already divested of hair—the bulbs having been destroyed by the growth of the tumour. If oozing of blood have not wholly ceased, it is advisable to maintain accurate pressure on the whole wound for an hour or two, so as to prevent the accumulation of blood within; an event necessarily fatal to adhesion. Indeed, such pressure is advisable after every such operation.

If the tumour be no larger than a nut, or small egg, it is unnecessary to remove any integument; and regular dissection is therefore not required. A more summary process by incision and evulsion of the cyst will then suffice.

If an encysted tumour, in a patient advanced in years, have suppurated, and be in process of intractable ulceration, it is well to remove the

part effectually, either by escharotics or by excision—the latter method the preferable ; for malignancy of action is otherwise apt to be assumed.

Solid tumours, of various kinds, are occasionally found in this locality. Of these, the most common is the adipose ; seldom of large size ; and amenable to the ordinary treatment—excision. Of whatever nature the tumour be, its removal should be early ; ere incorporation has taken place either with the scalp above, or with the fibrous textures beneath.

Erectile tumours very frequently occur in the scalp. They are best treated by deligation ; with or without previous reflection of the integument, according as this happens to be involved or not in the morbid structure. The very large tumours of this class, sometimes met with on the side of the head, need not be tied all at once, but may be dealt with in portions ; different parts being strangulated at different periods. Experience has proved that, in such cases, attempted excision is fraught with the utmost danger to life, and that deligation of the main arterial trunk, or trunks, is an insufficient remedial means ; cases may occur however, in which, as part of the cure, the principal arteries may be obliterated as they enter the tumour ; the twisted suture being employed for this purpose, as in the case of veins.*

Malignant tumours occasionally form in the scalp (Fig. 70, p. 179) following the usual course ; and amenable to the ordinary treatment. Benefit is to be expected only by free excision ; and that can be practised with expediency only at an early period. Medullary tumours may commence in the soft tissues, and involve the hard secondarily ; fully often, they originate in the bone.

Malignant ulcer of the scalp is not uncommon ; beginning as a warty excrescence ; or the result either of an originally simple sore, or of an open and degenerate encysted tumour. In one case of this kind, which lately came under our observation in a patient from Eskdale, Dr. C. Lisle informs us that the disease had continued as a simple encysted tumour for nearly thirty years before it ulcerated and became developed into a fungating medullary mass, the size of a small lemon. Early free removal is had recourse to ; if the lymphatics as yet present no contra-indication.

Pericranitis.

The pericranium becomes the seat of an inflammatory process, with or without external injury having been applied. Acute, it may be the result of wound or bruise ; following the ordinary course of such disease in fibrous tissues. Or acute suppuration may extend from the surface, as in erysipelas of the phlegmonous form. The usual antiphlogistic indications require to be fulfilled.

Idiopathic pericranitis is more frequently chronic than acute and seldom occurs but in the adult, who is saturated with the rheumatic diathesis, or who has sustained injury of the system by mercury and syphilis—one or other, or both. The ordinary symptoms are pressure, pain, swelling, heat, tightness ; and the nocturnal exacerbation is peculiarly marked. The affection may resolve, leaving little or no structural change ; or the resolution is incomplete, an enlargement of

* Dr. Warren, American Journal of Medical Science, April 1846.

bone remaining—resembling a diffused node, and sometimes involving the whole calvarium, which, thus hypertrophied, has been known in some instances to become enormously thickened. In some cases this thickening occurs upon the external surface ; in others, upon the interior, and at the expense, therefore, of the important contents of the cranium. In examples of the latter class, the change being a slow one, the effects produced are gradual, and time for accommodation is thus permitted ; or again, the inflammatory process may prove destructive, and the bone suffers, to a greater or less extent, by ulceration and necrosis. Usually the periosteum of other parts of the skeleton is at the same time and similarly affected ; and the bones most likely to suffer, along with the cranium, are the clavicles, sternum, tibiæ, and ulnæ.

Treatment is mainly constitutional. The primæ viæ having been brought into a tolerably satisfactory condition, a sustained exhibition of the alteratives, iodine and cod-liver oil, well known to be suitable to such cases, is proceeded with. The iodide of potassium is found especially beneficial. Locally, leeches and fomentations may be required at first ; then, counter-irritation. The inflammatory process having been checked, and its results only remaining, nothing is more effectual than the endermic use of a strong solution of iodine, or the application of repeated blisters. Throughout the whole period of cure, the hair is kept either shaved or short. Atmospheric exposure is carefully avoided ; and regimen is rigidly non-stimulant. If matter form acutely, it must be evacuated, freely and early. But if a chronic fluctuating swelling exists, there is no advantage obtained by making an opening ; as, by continued counter-irritation, absorption is almost certain to result. Even when rough and spongy bone can be plainly felt through the chronic collection of fluid, counter-irritation should still be persevered with—along with the internal use of iodide of potassium—when the affection is dependent on a constitutional cause ; for, in such cases, discussion will probably follow patient perseverance, even under circumstances by no means promising. Should acute or subacute accession supervene, however, the abscess becoming tense and crescent, let incision be no longer delayed.

In obstinate examples of pericranitis, causing mere change of structure, with slight swelling but great pain, the general health is apt to give way greatly, from want of sleep, and consequent exhaustion. In such cases it is essential to give opiates ; and if the more proper alteratives have proved ineffectual, mercury may be given in guarded doses. In such cases, however, its good effects may always be regarded with suspicion ; being usually only temporary, and afterwards followed by a more serious reaccession of the disease.

Affections of the Cranium.

Abscess and ulcer of the cranium occur from ordinary causes ; and are amenable to ordinary treatment.

The so-called *caries* of the skull is always preceded and accompanied by interstitial deposit of a new and gelatinous material, accompanied with absorption of the osseous elements of the part. It seldom occurs but with a vice of system—seeming to be rather a symptom and sign of

this, than to constitute a disease in itself. And the predisposing vices of system are—scrofula in the young, and syphilis, or mercurio-syphilis, in the adult. Treatment, accordingly, is chiefly constitutional. Locally, the diseased structure, if exposed, may be removed by the gouge, or by escharotics—chloride of zinc, or red oxide of mercury. But such operative interference is rarely needed; as Nature is provident in this matter, and herself effects the necessary clearance; the useless parts coming away spontaneously, as small sequestra. And such spontaneous evolution of the disease may be very materially assisted, by employing counter-irritation over the surrounding surface, and administering internally iodide of potassium and cod-liver oil. If the whole thickness of the cranium be involved, there is of course the additional danger of dura-matral involvement; and precaution requires to be exercised accordingly. Sometimes, unfortunately, a triumvirate of scrofula, syphilis, and mercurialism reigns in the system of the miserable patient; and then, as can readily be understood, the local affection proves particularly intractable.

Necrosis may involve the whole thickness of the skull (Fig. 234, p. 616), or affect the outer or inner tables separately; the result of injury, or commencing idiopathically—usually the former. Then, as already stated, there is risk to life by purulent accumulation between the bone and dura mater; and, if no external aperture already exist—as by fracture—the use of the trephine may be demanded. The opportunities for such operative interference are rare, however, as contrasted with the brilliant successes of Pott and others in former times; and we should be very sure of our diagnosis before resorting to a measure which the experience of living surgeons renders of very doubtful expediency.

Exfoliation, or death of the external portion, is more frequent than complete necrosis; the result either of external injury, or of chronic idiopathic pericranitis. The usual course of superficial necrosis is followed, here as elsewhere. Ordinarily, we wait patiently spontaneous separation, and then remove the sequestrum. Sometimes, however, when detachment is tedious, acceleration may be effected by the application of escharotics. And sometimes it is necessary to interfere and forcibly elevate the dead portion; which, though separated from the hard textures, yet confined by soft granulating structures around; or which, originally constituting a portion of the internal table, only communicates with the surface through an aperture in the external table.

In no form of necrosis of the cranium does the ordinary formation of cortical and substitute bone occur. And how provident such an arrangement is, at once becomes apparent, when we consider what would be the inevitable consequence of new bone bulging inwards on the dura mater. If the sequestrum have been superficial, healing is effected by a depressed cicatrix, as after simple ulcer of bone. When the whole thickness has perished, atonement is made for the deficiency, as after the operation of trephining.

As in the case of ulceration, many examples of exfoliation of the cranium are dependent on the mercurio-syphilitic vice of system; and all require constitutional treatment accordingly.

In connection with the traumatic form, it is well to remember the detachment of the periosteum—even rudely and with some bruising

the bone itself—does not render the occurrence of exfoliation inevitable. The part may, and frequently does, recover. And the treatment, in the first instance, is to be conducted with a view to such a result; the flap of integument being carefully replaced, the wound approximated, and speedy healing sought for.

Exostosis of the cranium is not uncommon; of a dense, ivory character; and usually of small size. Fortunately the site of growth is on the external aspect of the bone. No treatment is required. The affection is a mere deformity; and not even that, unless apparent from want of covering by hair.

Spiculated exostosis sometimes grows from the interior of the calvarium; inducing intense neuralgia, or epilepsy. As already stated, there are some few cases so plainly marked as to admit of the offending body being removed by the trephine.

Tumours of the calvarium—osteosarcoma and osteocephaloma—are rare; more especially the true osteosarcoma. When they do form, no treatment save mere palliation is advisable. The site and connections of the affected part forbid operative interference; unless, indeed, the tumour is of small size, has originated externally, is unaccompanied by similar formations elsewhere, and could be included in the crown of a trephine.

Polypus of the frontal sinus is a rare affection; and, in its first stages, of difficult diagnosis. When it exists, a similar condition will often be found, usually to a greater extent, in the other sinuses communicating with the nasal cavity; a fact well worthy of remembrance, as an assistance in diagnosis. When detected, cure may be obtained by removing the bone to such an extent as will permit evulsion of the growth, with subsequent cauterization of its site.*

Tumours of the dura mater involve the cranium secondarily. They are soft, fungating, and usually medullary. The original symptoms are necessarily obscure; but, after a time, the bone having yielded to absorption, the tumour manifests itself externally, and follows the ordinary course. Treatment is but palliative.†

* Brit. and For. Med. Rev., Jan. 1846, p. 186.

† Boyer, Œuvres Chirurg., tom. iv. Velpeau, Dict. de Médecine, tom. x.

CHAPTER XXXIII.

AFFECTIONS OF THE ORBIT, AND ITS CONTENTS.

I. AFFECTIONS OF THE ORBIT.

The Inflammatory Process,

affecting the orbit, is usually the result of injury, when primary. Sometimes it is of a secondary character, and unconnected with violence done to the part; an extension of the process from a neighbouring part—as from the eye-ball, or from the scalp. Most frequently it follows injury. And the affection is usually intense; suppuration being certainly and soon attained. Pain is great and increasing; tension is great, for swelling is hindered by the unyielding process of the periosteal lining of the orbit—termed orbital ligament or fascia—which confines the orbital contents in front; vision is more or less impaired by compression of the eye-ball and this organ, according to the amount of deep swelling, is more or less protruded; the eyelids are red and œdematous, the conjunctiva tumid, its submucous texture infiltrated with amber-coloured serous fluid; in inflammatory fever is intense, and the cerebral functions are often prominently disordered. In some cases, the morbid condition is only part of an intracranial inflammatory affection—symptomatic of its advanced stage and the occurrence of suppuration.

Treatment comprises the ordinary antiphlogistic indications. When a wound exists, careful examination is expedient, to ascertain whether or not any foreign substance—as straw, wood, iron—has penetrated and is lodged; and if such an obvious exciting cause of the inflammatory process be detected, it is forthwith removed. Leeches are applied in numbers; in some cases, general blood-letting may also be found advisable; and the antiphlogistic accessories to blood-letting—aconite or antimony, purgatives, quietude, etc., will not be neglected; vomiting being avoided, for obvious reasons. The part is diligently fomented; and so soon as indications exist—however faint—of matter having formed—or even when the tension is great, an evacuating incision is practised; it being obvious of the greatest importance to penetrate the orbital ligament at an early period of the suppuration. On evacuation of matter, the symptoms are speedily mitigated; the tension, throbbing, and intense pain almost immediately. If incision be delayed, spontaneous evacuation takes place but not till after much suffering, considerable destruction of texture, and dangerous impairment of function in the eyeball. Such incision should always, if possible, be made through the conjunctiva, and not through the textures of the lid; as the puckering, which would almost

certainly ensue, would produce more or less serious deformity of the eyelids.

Wounds of the Orbit.

These are usually of the punctured kind. As just stated, they are liable to prove the exciting cause of an intense inflammatory process, more especially when there is lodgment of foreign matter. And the probability of the latter circumstance must always be regarded in practice; especially when occasioned by an explosion, as then gravel, or fragments of stone, of metal, or of wood, are liable to become lodged, and if left, are certain to occasion most disastrous inflammatory consequences. The wound having been ascertained to be clean and free, is carefully approximated; and cold is continuously applied, with much care, in order to avert the inflammatory process, if possible, and secure union by adhesion. When the wound is lacerated, the application of water-dressing will be found preferable to the use of poultices. If the inflammatory process supervene, antiphlogistic treatment must be early and active; a suppurating wound may be then inevitable; but we hope to avert deep and confined abscess, which is prone to form by extension of the inflammatory process beyond the wound's track. During the whole progress of such a case, the condition of the eye within the tumid eyelids should be ascertained; and all collection of matter within the swollen eyelids should be prevented by frequent bathing with tepid water, or with a weak narcotic lotion.

But such injuries acquire a still higher importance, in reference to the parietes of the orbit. A penetrating wound of the orbit—as by a cane, a fencing-foil, bayonet, pike, or pitchfork, a tobacco-pipe or a scissors' point—is not unlikely to produce fracture of the orbital plate; and the fragments of the broken bone, driven inwards, are certain to penetrate or otherwise injure the brain or its membranes; endangering life, perhaps immediately, by extravasation of blood—more probably by the results of inflammatory progress at a more remote period. Such wounds, therefore, require to be treated with the greatest caution. The extent of injury done to the bone is ascertained as soon, as accurately, and as gently as possible. If loose fragments are found to exist, these it is well to remove; the external wound being dilated, if need be, for this purpose. And when the spicula are certainly displaced inwards, injuring the important parts in that direction, an attempt should be made to take them away, whether they seem detached or firm. The indication is as paramount as in punctured fracture of any other portion of the cranium. This important part of the treatment having been satisfactorily accomplished—by dilatation of the external wound, and the suitable use of fingers, forceps, and probe—the patient is placed on his face, with the wound unapproximated, until bleeding cease; internal extravasation being thus rendered less likely to occur. Then the parts are brought together; and antiphlogistics are diligently employed, both locally and generally, in order to avert, if possible, an untoward amount and extent of the inflammatory process.

Tumours of the Orbit.

Hard Tumours of the orbital parietes are uncommon. The dense ivory exostosis produces little inconvenience, is usually of inconsiderable size, and requires no treatment. The cancellated exostosis—of a pedunculated character, and larger dimensions—may incommode the eyeball. If so—the nature of the case being plain—an incision may be made on the origin of the growth; its neck may be cut by the bone-pliers; and, by careful dissection, the offending substance may then be removed.

Soft Tumours are of more frequent occurrence. And they may be practically divided into four classes. 1. The simple and sarcomatous amenable to excision. 2. The erectile; capable of cure, but not generally by direct operation. 3. The malignant; usually forbidding operation, and admitting only of palliation. 4. The chronic inflammatory and syphilitic.

1. The simple tumours—simply sarcomatous, fibrous, fatty, cystic—may form in the orbital areolar tissue, unconnected with either the bone or its periosteum; and the growth may be either of idiopathic origin, or a remote consequence of slight injury. Enlargement is slow, gradual comparatively painless, and unattended with inflammatory signs; not likely therefore to be mistaken for orbital abscess. As in the latter affection, however, outward growth is prevented by the orbital ligament compression of the eyeball follows; and this organ may be more or less first displaced, and then protruded from its socket. At first, sight not lost, and scarcely even impaired; for stretching of the optic nerve gradual, and nervous as well as cerebral tissue has a very considerable power of accommodating itself to displacing agencies gradually applied. Ultimately, however, the stretching and displacement are attended with more or less impairment of vision.

By careful inquiry into the history of the case, we satisfy ourselves that the tumour is of the simple kind—although of what exact species, may not be easy to determine; for the tense orbital ligament, stretched over the swelling, obscures tactile examination. Generally, however, we are able to satisfy ourselves on another point; whether or not the tumour is movable—connected or not with the bone and periosteum—consequently removable or not, entire, by operation. When convinced that the tumour is simple and movable, we do not hesitate to attempt its extirpation. The wound is made of sufficient extent, in a line parallel to the fibres of the orbicularis muscle. By cautious dissection, the tumour is reached and exposed. It is then laid hold of by a volsella, or hooked forceps; an evulsion outwards being steadily yet gently maintained, extirpation rendered both easy and safe. The point of the knife is moved very warily, when near or in contact with the orbital parietes; for these, the pressure of the tumour, may have been much attenuated; and careless movement of the instrument might cause penetration. The eyeball and optic nerve are also carefully avoided. After removal of the tumour, the former is carefully readjusted in its proper place; a restoration of its functions usually ensues. The wound is brought together, and treated for adhesion.

In some cases, by dividing the external commissure as far as the

malar margin of the orbit, and cutting through the conjunctiva and fascia, either above or below the globe, and its motor muscles, sufficient space will be obtained to suffice for the removal of a tumour, without any interference with the lids; a procedure which is always followed by more or less cicatricial puckering and deformity.

Partial removal even of the simplest tumour, in this situation, is obviously inexpedient. For, reproduction will almost certainly occur from the portion which remains; and such second formations are very apt to prove of an unfavourable kind.

2. The Erectile tumour is occasionally found occupying the orbit. It is seldom congenital; but occurs suddenly, in after life; and its origin is usually attended with a considerable amount of pain. At first an obscure deep swelling is found, causing more or less inconvenience; but as it enlarges, and approaches the surface, the ordinary characteristics of erectile tissue become sufficiently apparent. Often the cheek is covered with large veins—recipients of the blood from the more active vessels within.

In some cases apparently of this kind, when the death of the patient has afforded opportunity for post-mortem investigation, no aneurism by anastomosis, or vascular enlargement whatever, could be found; an increased secretion of fluid in the areolar tissue, and atheromatous product in the ophthalmic artery, being all that could be pointed to as of pathological origin.

This tumour cannot be treated directly, either by knife, or by ligature. Yet, if no remedial means be adopted, the probable issue will be unfortunate; by enlargement, ulceration, hemorrhage; by involvement of the orbital parietes, and subsequent pressure on the brain; or by mere constitutional irritation. Experience, in several such cases, has proved that deligation of the corresponding carotid is capable of effecting a cure; not by obtaining consolidation and obliteration of the dilated vessels; but, probably, by diminishing their supply of blood, removing the impulse of the heart's action, and so favouring resumption of the normal calibre.

In some few instances, the supply of blood will be found so manifestly connected with the arterial branches which ramify around the orbit, as to admit of deligation of the direct feeding trunks of the erectile growth. This can be effected, with least deformity, by passing a curved needle armed with silver wire beneath the vessel, and twisting or tying the suture—thus compressing the vessel against the skin so as to arrest its vascular current. In other instances, astringent injections have been found to effect a cure; matico, gallic acid, tannin, alum, and perchloride of iron, having been used for this purpose. But all such procedures, where the circulation between the arteries and veins is so free, must be regarded with some suspicion; as the risk of some portion of the coagula thus formed being carried into the circulation, and giving rise to embolic results, is imminent.

3. Tumours of a malignant kind—medullary—are no unfrequent occupants of the orbital cavity. Generally they originate in the eyeball; but occasionally this is involved only secondarily—the origin being in the orbital areolar tissue, in the periosteum, or in the bone. The sole

hope of cure is by extirpation of the whole orbital contents. And this is expedient only when the disease is recent, apparently limited to the soft parts, and capable of entire removal.

4. Inflammatory and syphilitic affections of the bone, periosteum, or soft textures of the orbit, of idiopathic origin, or accompanying the tertiary stage of syphilis, closely simulate the last form of tumour, and may be easily mistaken for it. The simply inflammatory must always be difficult of discrimination; and the diagnosis only becomes certain by the observation of the progress of the case, and the effect of treatment. When of syphilitic origin, the presence of other affections of a like kind, situated on the cranium or elsewhere, and the general history of the case, will afford the only sure means of arriving at certainty in diagnosis. Blisters to the temple, iodide of potassium, and sometimes even mercurials, internally, with the use of glycerine in a diluted form, to protect the protruding globe, should such a complication be present—will constitute the appropriate treatment.

II. AFFECTIONS OF THE EYELIDS.

Injuries.

Ecchymosis is of frequent occurrence in the eyelids; the areolar tissue being lax and delicate. Ordinarily it is the result of a bruise or blow; but it may follow a wound, more especially if oblique or sub-integumental; and the application of leeches to the lids is almost certain to produce it, to a greater or less extent. It is important as a deformity. A patient, having received an injury likely to be followed by ecchymosis, is anxious that this should be prevented; and, the escape of blood having occurred, he is equally anxious that the discoloration should be removed. Many remedies are popularly in vogue for both of these ends. For the former, the continuous application of cold by wetted lint, with quietude and abstraction of all stimuli, is both suitable and easily obtained: if begun immediately on receipt of the injury, and properly maintained, the natural hemostatics will be much favoured, and very probably little or no blood will escape from the torn vessels. Ecchymosis having occurred, the nature of the application must vary according to the presence or not of the inflammatory process in the part; in the one case, fomentation is employed, subjugation of the morbid process being the paramount indication; in the other, a solution of the muriate of ammonia, or of tincture of arnica, or a poultice of black bryony root, is applied, in order to hasten removal of the extravasated blood by absorption.

Wounds of the eyelids, if contused, are treated by the water-dressing. If incised, after bleeding has ceased, approximation is effected by fine sutures; other retentive means being plainly inapplicable to this locality. Great care should be taken to restore the normal relative position with accuracy, lest deformity ensue.

In the case of burns, much precaution is required during the process of healing; lest by contraction ectropion supervene. And the careful

dressing and bandaging necessary for this purpose is continued even for some time after the parts have healed.

Foreign Bodies.

Foreign bodies of small size—as particles of sand, dust, glass, coal—very frequently lodge under cover of the eyelids, on their conjunctival lining. The patient, suffering much pain and irritation—with the eye already red, intolerant of light, and profusely lachrymating—applies for our aid on account of “something in his eye.” Gently opening the eyelids, before a steady light, we scrutinize the eyeball in the first place; directing the patient to roll the organ in various directions, in order to facilitate such examination. If particles are found adherent, they are in general easily removed; by a curette, or flat end of a probe; by a hair pencil; or by a fold of a soft handkerchief. If fine dust only have lodged, fomentation and ablution will ordinarily suffice. Sometimes it may be necessary to inject a gentle stream of tepid water, by means of a small syringe. In other cases, it is enough to shut the eye, or keep it shut, for a few minutes—occasionally blowing the nose; thus favouring the natural washing away of the foreign particles, by increased lachrymal and conjunctival secretion. The eyeball having been duly scanned, the lower eyelid is next examined; its conjunctival lining being readily exposed to a sufficient extent, by simple depression of the part. But the upper eyelid is the site most frequently occupied by the foreign substance; and it cannot be sufficiently exposed, without eversion. This is effected by placing a probe horizontally across the lid, above its cartilage; taking hold of the eyelashes with the finger and thumb; and bending the eyelid backwards over the probe. If the foreign matter be loose, it is removed by any of the means already mentioned. If it be firmly lodged, the point of a tooth-pick, of a couching needle, or of the eye spud, will most conveniently effect its dislodgment.

In certain occupations, particles of steel or iron are apt to get between the eyelids, and often become impacted in the cornea, and require the point of a couching needle, spud, or minute gouge-shaped instrument, to effect their dislodgment.

When no assistance is at hand, the patient may himself, in many cases, get rid of the irritating matter; by elevating the upper eyelid with the fingers of one hand, and pulling it downwards, while he at the same time closes the lower, and pushes it upwards. Having pressed gently over the globe, the finger is then withdrawn, and the lids allowed to separate. The eyelashes of the lower lid are thus made to sweep the conjunctival lining of the upper; and it is in the latter situation, as already stated, that foreign bodies of small size usually lodge.

When grains of gunpowder, fragments of sand, gravel, wood, or metal, are lodged beneath the conjunctiva, their presence as foreign bodies sets up the inflammatory process sooner or later; and this consideration should therefore determine their removal at once. This can be most easily effected, usually, by picking up the portion of conjunctiva which covers them, by means of a pair of fine artery forceps, and snipping it away with a pair of small curved scissors. The fragment, if not re-

moved in the little bit of conjunctiva, will be so exposed as to be easily picked off. When quick lime is lodged within the eyelids, its caustic action may, unless speedily removed, produce such destructive effects that the vision of the patient may be lost, either from the immediate destruction of tissues, or from the consequent inflammatory process which ensues. The fragments in such a case should be carefully removed, as far as is practicable ; and then a weak vinegar lotion should be employed, to neutralize what remains.

The foreign body having been removed, the eye is closed ; light is excluded ; and antiphlogistics are employed according to circumstances. It is plain that if the foreign substance be not removed, the inflammatory process will certainly be established, and probably prove untoward and intractable. Cases are not wanting in which complete destruction of vision has been the ultimate result of but a small particle of foreign matter lodging in the conjunctival lining of an eyelid ; perhaps with much injury done to the system, by severe and sustained treatment directed against the inflammatory process and its results.*

Blepharitis.

The inflammatory process, attacking the eyelids, is so named. It may follow injury ; assuming the ordinary character and course, and amenable to the ordinary treatment.

In erysipelas of the face, affection of the eyelids is usually a most prominent symptom ; the laxity of their areolar tissue admitting of much and unseemly swelling. Punctures are usually necessary ; not so much to abstract blood, as to evacuate serous accumulation, which may be so extreme as to invert the ciliary margin against the surface of the globe. After recession of the primary symptoms, this part must be closely watched ; for, during convalescence, reaccession of the inflammatory attack is very apt to occur, advancing rapidly to suppuration. And unless an early incision be made here, the abscess will be large, and the integument will probably slough.

In many cases the red, tumid condition of the eyelids is symptomatic of an acute and destructive inflammatory process going on within ; and must in such cases be regarded as an indication of the serious progress of the affection.

Ophthalmia Tarsi. Lippitudo.

By this is meant a congestion, or chronic inflammatory process, affecting the eyelids ; more especially at their margins. Beginning usually in the Meibomian follicles, a viscous, disordered secretion adheres to the eyelashes, tending to cause cohesion of the ciliary margins. More or less lachrymation, in general, exists. The eyelashes are stunted, or deficient ; the tarsal margin becomes thickened, the cartilage of the lid is modified in its nutrition, and incurvation of it may be the consequence. Itching, heat, and intolerance of light, are usually present ; and the general expression is bleared and unpleasant.

The disease will usually be found co-existent with some vitiated con-

* Lancet, No. 1061, p. 435. One among many.

dition of the general system ; and to that the treatment must be mainly directed. Not unfrequently, the constitutional vice will be found of the scrofulous character. If pain, heat, redness, and other ordinary characteristics of the inflammatory process exist at all prominently, blood is to be taken sparingly from the part, by scarification of the conjunctiva, or by leeches at the inner canthus. For a few days afterwards, fomentations, medicated or not, are to be applied. Then stimulants are used ; such as solutions of zinc, or nitrate of silver ; the ung : nitratis hydrargyri diluted ; or an ointment containing the iodide of mercury. In obstinate cases, counter-irritation is sometimes useful ; and this is best effected by the application of blisters behind the ears. In children, the state of the gums and teeth must be looked to. In most cases, the application of nitrate of silver to the external surface of the margin of the lids, and the smearing on of oxide of zinc ointment within the line of the eyelashes, with cleanliness and good food, is all that is required to arrest the affection at its commencement.

An advanced form of this chronic affection of the eyelids is sometimes termed *Lippitudo*. The ciliary margins are red, thickened, everted, and denuded of hair ; and the eye seems to be surrounded by an angry red circle. The general expression is consequently very unpleasing ; and the patient's discomfort is also great. Local and general alteratives are pre-eminently required ; but they often fail to prove quite satisfactory. Stimulants applied to the parts are useful ; such as pencilling the lids with a solution of nitrate of silver, and the like.

In such cases, where the puncta are everted, and *Stillicidium lachrymarum* exists, the slitting up of the lachrymal canaliculus, in the lower lid, as far as the sac, should be had recourse to ; after which the parts become gradually restored to their normal condition, and require no application of any kind.

Not unfrequently, ophthalmia tarsi is but a part of a more general affection of the eye, of a strumous or gouty character.

Hordeolum, and other Swellings.

By Hordeolum, or *Stye*, is meant a circumscribed inflammatory swelling, which may either remain of an indolent and indurated character, or advance to suppuration. In the latter case, discharge of matter takes place, and discussion slowly follows. Very frequently the affection originates in a Meibomian follicle, and resembles an ordinary pimple. The follicle is obstructed, and its contents accumulate ; an inflammatory process is then kindled in the perverted part, suppuration takes place, and the enlarged follicle becomes the seat of a small acute abscess. This may be recognised to be the course of the affection, by everting the lid during the early stage, when on the inner side of the cartilage the yellow line of the distended follicle will be seen. By puncturing this, a single drop of matter escapes, the irritation subsides, and all the tardy progress and pain of the stye, when left to itself, will be averted.

Here, too, the general health will be found amiss ; and purgatives, alteratives, with regulation of diet, will probably be required. While the swelling is nascent, fomentation and water-dressing are suitable.

When matter has formed, and bulges the margin of the lid, a puncture should be made at the apex of the swelling, for efficient discharge ; and then water-dressing is again applied. If a chronic hardness should threaten to remain, discussion of this will be promoted by pencilling the part lightly over with a solution of iodine, or of nitrate of silver ; or the offending accumulation of the follicle may be evacuated by puncture on either the inner or outer side of the cartilage, according to the aspect on which the affected follicle is situated.

An inflammatory swelling, similar to the true hordeolum, may form in the ordinary areolar tissue of the eyelid ; resembling a small furunculus. It is amenable to ordinary treatment.

Small, hard swellings, of a whitish colour, very superficial, painless, and almost stationary, occasionally form beneath the integument of the eyelid. According to their size, they are termed either *Grando* or *Milium* ; according as they most resemble a hail-stone or a millet-seed. Causing deformity, they require removal. A scratch is made through the thin cuticle stretched over them, and the white pearly-looking substance is squeezed out. They are in fact encysted tumours on a very small scale. No escharotic is necessary. The wound is painless, scarcely bleeds, and heals simply.

Warts sometimes form on the eyelids. They should be taken away by scissors. Ligature and caustic cause pain, and the latter may produce deformity.

Encysted Tumours of the Eyelids.

Encysted tumours are of frequent occurrence in this situation ; more especially in the upper lid. They are usually of small size ; the contents are clear and glairy ; the cyst is extremely delicate. Their original site is subcutaneous, on the external aspect of the tarsal cartilage ; but as they enlarge, the cartilage becomes thinned, and the cyst bulges the mucous membrane inwards. The majority of the patients are of the female sex. The tumours are rarely single, and this serves to explain the supposed reproduction of the cyst in some cases where the operation has been effectually performed.

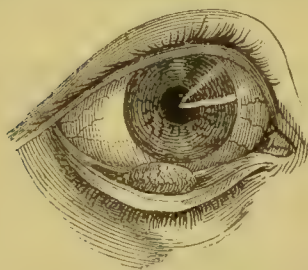


Fig. 238.

Removal by regular dissection is impossible ; and though it may be tempting to one who is inexperienced, need not be attempted ; the cyst is too delicate, and always adheres to the tarsal cartilage. For the same reason, incision, with evulsion of the cyst, is inapplicable. It is sufficient to incise the part from the inner aspect of the lid, to squeeze out the contents, and with the point of a probe to disturb and break up the tender cyst from day to day, so as to prevent too speedy healing of the opening and recollection of the fluid. In some cases it has been recommended to apply nitrate of silver on the end of a probe, after the bleeding has ceased, so as to ensure the cyst's destruction, and consequent non-repro-

Fig. 238. Encysted tumour of the lower eyelid. The lid everted, the projection resembles the condition described in the text, when the sac has spontaneously given way.

duction of the tumour ; but there is no occasion for any such interference. The incision is effected by everting the lid, and then cutting through the stretched and prominent bit of tarsal cartilage, in a horizontal or crucial direction ; or, when the tumour is large, by passing a sharp hook through the translucent-looking part of the sac's wall, the bit is cut out by two elliptical incisions, so as to leave a free opening. When left to itself, an encysted tumour of the lid sometimes gives way internally ; a fleshy-looking granulating surface then projects, and by rubbing against the globe causes great irritation. In such cases the lid should be everted, and the prominence clipped off with small curved scissors ; after which nitrate of silver solution may be dropped upon the surface occasionally, till all congestion is removed.

Hypertrophy of the Upper Eyelid.

The upper eyelid is occasionally affected by hypertrophy of both its integument and mucous membrane. The swelling is considerable, and causes deformity ; it also obstructs vision ; and there is an unpleasant puriform discharge.

By two elliptical incisions, a sufficiency of the diseased integumental texture is removed ; and the wound is approximated by suture. The conjunctival change is subsequently remedied by scarification, followed by the use of sorbefacients. Or should the conjunctiva resist this gentler means, partial ablation of it may be practised by clipping it away with scissors.*

Cancer of the Eyelids.

Malignant ulceration is usually preceded, in the eyelids, by warty formation. The only cure is by excision ; early and free. If the disease be limited, sufficient removal may be effected, yet without deformity or exposure of the eyeball ; the wound being so shaped as either to come well together by suture, or to admit of the transplantation of a cutaneous flap to occupy the gap. But when the disease is extensive, and an operation warrantable, the prevention of deformity need not enter into our thoughts. One paramount indication is present—removal of all the diseased part. That must be effected, at whatever sacrifice of texture.

When it is found necessary to remove the whole or greater part of the eyelids, more especially the upper, on account of malignant ulcer, it comes to be a question whether or not it be politic to spare the eyeball—supposing it to be sound. Some writers recommend its removal at once ; considering that the organ, being deprived of its natural protection, will be destroyed by inflammatory change. Although this is not always the case, yet, when satisfactory restoration of the eyelid by a plastic operation cannot be effected, there is no advantage to be gained by subjecting the patient to all the pain of a gradual destruction of the globe by inflammatory change before we remove the eyeball. This is rendered all the more decided as a rule, as the operation of excision of the eyeball has been rendered almost free from danger by recent improvements.

* LISTON, *Lancet*, No. 1089, p. 489 ; Haynes Walton, *Op. Ophth. Surg.*, pp. 137-8 ; Syme's *Clinical Surgery*, 2d Edit., p. 175.

Intractable ulcers of the eyelids—not malignant—of the nature of lupus, are best treated by regard to the state of the system, more especially of the digestive organs ; and by occasionally touching the parts with the fluid nitrate of mercury, or nitric acid. Sometimes they are of a syphilitic character ; obviously dependent mainly, for cure, on constitutional treatment. In children, secondary syphilitic ulceration of the lids is frequently extensive, though not deep, and requires careful dressing with black or blue wash. In adults, the ulcers are usually rodent, and depend upon a more advanced stage of the disease. In such circumstances, unless checked, hideous deformity, or even complete destruction of the lids and globe, may result.

Anchyloblepharon and Symblepharon.

By the term *Anchyloblepharon* is understood, union of the eyelids at their tarsal margins ; congenital ; or accidental, the result of cicatrization after burn or scald. When congenital, the cohesion is seldom to a great extent ; occupying only the angles. No interference may be deemed necessary. When more extensive, causing not only an unseemly deformity, but likewise interfering with vision, separation of the preternaturally united parts may be readily effected by incision. Afterwards, all necessary means should be taken to prevent reunion ; each lip of the wound being made to cicatrize separately, by granulation. When the closure is complete—a circumstance of rare occurrence—a fold of the parts should be first raised from the ball, and cut through in a horizontal direction ; through this aperture a director is carefully introduced ; and on it the subsequent division to the angles is safely effected. The accidental form is amenable to similar treatment. But greater care is necessary, in the after management, to avoid reunion. This is prevented by the interposition of dressing, frequent movement of the parts—and, if necessary by forcible separation of the lids by plaster, and the application of somewhat astringent lotion.

By *Symblepharon* is meant adhesion of the eyelids to the eyeball seldom congenital ; usually the result of cicatrization after injury. In some cases, the cicatrix is dense and contracted ; admitting of no attempt at cure. In others, the adhesions are comparatively slight, and there is sufficient laxity of texture. In these latter, the lids are to be liberated by careful dissection ; and all traces of cicatricial tissue are to be carefully dissected off the surface of the cornea. The after treatment is, in such cases, the matter of greatest difficulty ; and reunion is much more liable to take place than in anchyloblepharon. It is best prevented by frequent motion of the eye, by proper dressing, and by the occasional introduction of a probe to separate the new adhesions. The temporary insertion of an artificial eye has been suggested, and the use of a flattened ring of silver has also been recommended, to maintain the separation of the lid and globe at their circumference, until cicatrization is complete ; but even the most persevering exertions have often proved unsuccessful.

Lagophthalmos.

Lagophthalmos, or Hare-eye, means an inability to close the eyelids from diminution of their perpendicular diameter ; and the eye, being deprived of its natural protection, is exposed to the action of the air and other external irritants, which may cause an inflammatory affection of the conjunctiva, eventually terminating in opacity of the cornea. The disease affecting the lower lid often results from paralysis of the orbicularis muscle, caused by exposure to cold ; more frequently it is caused by retraction or shortening of one or both lids, arising from cicatricial contraction following abscess, or caries of the orbital walls, or burns and other injuries. Sometimes it proceeds from cold, or other causes acting upon the facial nerve in its transit or distribution.

The treatment varies according to the cause. When the affection arises from reflex paralysis, blisters, friction, electricity, and strychnine are appropriate ; when from retraction of the lid, subcutaneous division or excision of the cicatrix, where attached to the bone, may be of use ; or a flap, by plastic operation, may be turned in to occupy the gap left by free incision made to liberate the lid. When the cause is affection of the facial nerve, leeches, blisters, and stimulants in the course of the nerve are to be employed. When it is caused by cerebral congestion, antiphlogistic remedies are to be had recourse to.

When the paralytic gaping of the lower lid is great, excision of a V shaped portion of its whole thickness, with accurate apposition of the cut margins, will sometimes be required to protect the eyeballs ; and when the upper lid is permanently elevated, Dieffenbach recommends the subcutaneous division of the levator palpebræ.

Ptoſis.

Ptoſis is a falling downwards of the upper eyelid ; producing no inconsiderable deformity, and seriously interfering with vision. It may constitute a disease of itself ; or it may be but a symptom of serious affection of the brain, or of the third nerve—and is then accompanied with *Lusctas* and dilated pupil. When original, it may depend on debility of the elevating muscle, or on superfluity or thickening of the integument ; or it may be connected with both of these circumstances.

Redundancy of integument is easily got rid of, by removing a sufficient portion, either by knife or by scissors. Atony of the muscle may be overcome by stimulant frictions, the passing of electricity, or the endermic use of strychnine. Ordinary means having failed, an operation may be had recourse to. A large portion of integument is removed from the eyelid, and also from a corresponding portion of the eyebrow ; the two raw surfaces are then brought into apposition by suture ; and when union has taken place, the lid will be elevated by the action of the occipito-frontalis muscle, to such an extent as to admit of useful vision.

In the secondary form, dependent on affection of the brain, or of the third nerve, treatment must of course be directed to the part affected, of which the ptoſis is a mere symptom. In by far the greater number of such cases the disease will be found to be traceable to syphilis, from

which the patient has antecedently suffered. Mercury and iodide of potassium will, in such cases, prove of great service, and a satisfactory result may be anticipated—though a considerable interval may be expected to elapse before the muscles regain their power.

Trichiasis, and Distichiasis.

Trichiasis denotes inversion of the eyelashes, whereby much irritation is induced on the surface of the eyeball. The inversion may implicate the whole cilia, or only a few. It may occur in either lid; but is most frequent in the upper. The position of the eyelid itself is not altered. At first there is merely inconvenience; but, sooner or later, an inflammatory process is established on the surface of the eyeball, and consequent danger to vision may prove great.

Treatment is either palliative or radical. The former consists in evulsion, from time to time, of the erring cilia, and mitigation of the irritation and inflammatory process which they may have occasioned. For evulsion, a pair of broad-pointed forceps, with their opposing surfaces in accurate contact, are required; for the hairs are usually both slender and light coloured; and, besides, the assistance of a lens is often necessary. This method is on the whole unsatisfactory; and is only applicable to those cases in which but a few of the cilia are in fault.

To effect a radical cure, it is essential that the lashes be not only removed, but that their non-reproduction shall be insured. One of two methods may be followed. The errant cilia may be plucked out, and their bulbs destroyed. Or the bulbs and cilia both may be removed by cutting instruments. The former method is applicable to the partial trichiasis; the latter to the complete. If the former be chosen, an incision is made with the point of a lancet, on the free margin of the lid down to the roots of the inverted cilia; into this little opening a needle or another lancet, coated with powdered tartrate of antimony, is inserted—allowing it to remain so that its coating may dissolve there; and the hairs are then pulled out. A small pustule forms, and the bulbs are destroyed.*

When it is our object to remove not only the cilia but their bulbs, a horn spatula is introduced beneath the lid, and an incision is made down to the tarsus along the whole length of the inverted portion, parallel to and about a line from the ciliary margin, to which it is to be connected at each extremity; the ciliary edge is then to be laid hold of with forceps, and the integuments carefully dissected from the cartilage, so as to include the bulbs without interfering with the mucous edge of the lid. When the part cicatrizes, little deformity will result. Or, the margin of the lid is laid hold of and stretched, by the fingers of the left hand, or by forceps; and by the stroke of scissors, or the sweep of a fine bistoury the requisite amount is taken away. By operating in this way, more deformity will be produced than by the former plan; but by either the eyeball will be freed from a continual source of irritation. The objection to any of these methods, which have for their object the destruction of the cilia, is that the eye is left unprotected, particles of

* Edinburgh Monthly Journal, April 1841, p. 259.

dust, etc., gain free access within the lids, and constant inflammatory irritation is kept up till the result is nearly as disastrous as if the inverted cilia had been left alone.

By *Distichiasis* is understood a row of supernumerary cilia, growing inwards, and causing the same unpleasant and untoward results as the foregoing affection. They are not in reality any new development, but displaced and atrophied eyelashes, which have undergone this deviation in consequence of long continued irritation of the glandular textures in the margin of the lids. The same treatment is required as for trichiasis. But more careful examination is expedient; inasmuch as the observer is apt to be deceived by seeing the ordinary eyelashes of their normal character; and, even when the lid is raised and scrutinised, the paucity, slimness, and paleness of the stray lashes, or the glutinous mucus which adheres to them, may often cause their presence to be overlooked;—a serious matter; for unless they be noticed and removed, the inflammatory process will not only become established, but will prove uncontrollable. To detect them readily, the lid should be inspected laterally, as well as in front; and the patient should be desired to turn his eye in different directions, so as to form a dark back-ground of the iris and pupil.

Entropion.

This is a turning in, not only of the eyelashes, but of the margin of the eyelid itself, attended with all the unpleasant consequences of trichiasis, in an aggravated form. It may be temporary or permanent. In the former case, it is the result of inflammatory swelling of the eyelid; “the tumefied conjunctiva pressing out the orbital edge of the tarsus, while its ciliary margin is turned inwards by the action of the orbicularis.”* In other instances, when there is no swelling, the irritability which is present produces such extreme spasmodic contraction of the orbicularis, that the tarsal margin of the lower, and sometimes even of the upper lid becomes inverted. When it occurs in elderly persons, it will generally be found to depend on relaxation of the integument of the lid, flaccidity of the tarsus, and spasm of the marginal muscular fibres of the orbicularis, whereby displacement inwards of the ciliary margin is produced. In the permanent form, the deformity may be due to contraction of a cicatrix on the conjunctival aspect of the lid, whereby the ciliary margin is directly pulled inwards; or, worst of all, it may depend on incurvation of the tarsal cartilage itself, in consequence of *ophthalmia tarsi*, *psorophthalmia*, or other chronic disease. Either eyelid, or both, may be affected. In some cases a cicatrix of the cheek, or of the temporal, or of the frontal region, may produce ectropion of one lid and entropion of its fellow.

It is evident that treatment must be both early and suitable, if we

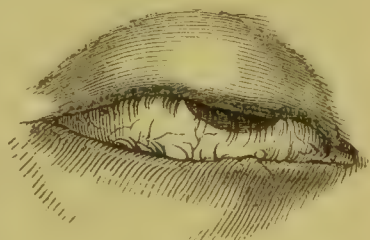


Fig. 239.

* LITTELL on Diseases of the Eye, p. 95.

wish to save the eyeball from serious injury. In the temporary form, it will be sufficient to oppose inversion by the application of contractile collodion, or retracting plasters, frequently renewed, until the cause of displacement has been removed by treatment directed towards subjugation of the inflammatory process and dispersion of its swelling. In other instances, subcutaneous tenotomy of the orbicularis may be practised with success. If the integument be redundant, a portion may be pinched up and retained by being drawn through an elongated loop of elastic steel wire, or held by a minute pair of spring wire forceps; or a more permanent effect may be produced by the removal of an elliptical portion of the integument, together with the subjacent portion of muscular fibres. Care is necessary in determining how much is to be taken away, so as to insure rectification of the position of the eyelid; while yet we avoid removing an unnecessary amount, and so causing an opposite condition of the parts—*ectropion*. A horizontal fold is pinched up by suitable forceps, or by the fingers, and is removed by curved scissors. This wound, to be effectual, should usually include all the skin from about a line above the tarsal margin, to within the same distance of the margin of the eyebrow. The gaping raw surface appears nearly circular. After bleeding has ceased, the edges are united by sutures, and adhesion follows. Escharotics may be employed for the same purpose; but they are inferior to cutting instruments, being possessed of no exactitude as to the amount of texture to be destroyed. Sulphuric acid is usually recommended for this purpose; when used, it is applied to the external surface of the lid, above the margin of the tarsal cartilage, by means of a wooden lucifer match soaked in the monohydrated acid. The application is momentary, but very painful. A slough forms of a black charred aspect; and the contraction which follows its separation effects a cure. The eye, however, must be carefully guarded from the acid during its application to the lid. It should only be preferred in cases where the patient will not submit to an operation by sharp instruments.

When the disease is dependent on a perverted state of the ciliary margin and tarsal cartilage, various methods may be adopted. The cilia and their bulbs may be removed, as for trichiasis; care being taken to leave the puncta lachrymalia intact. Or, by operations such as the following, an attempt may be made, retaining the eyelashes, to liberate and restore them to their normal position. The first expedient was proposed by Mr. Streatfield. "A horn spatula is introduced below the lid, thus rendering its surface tense. An incision is made parallel to the ciliary margin, over the convex aspect of the cartilage, so as to admit of the removal by two incisions of a narrow wedge-shaped slice of the tarsal cartilage, leaving a groove extending longitudinally from one end to the other of the cartilage. The incurvation of the cartilage is thus compensated for, the free margin of the lid everted, and, by the introduction of a few points of fine silver wire suture, the wound unites by the first intension; or, the inverted lid is separated from the globe of the eye by means of the finger or a sharp hook; and then with a pair of strong scissors, two perpendicular incisions are made through the tarsal cartilage, each about a quarter of an inch in length, the one upon the temporal, the other upon the nasal side, avoiding the punctum, and

cluding the whole inverted portion of the lid. This part being now everted, and held in that position, the two perpendicular incisions are connected by a horizontal incision upon the conjunctival surface, close to the ciliary margin, by means of a scalpel; cutting through the conjunctiva and tarsal cartilage, and leaving the inverted portion of the margin united to the rest of the lid merely by the integument. And especial care is taken that the knife does not penetrate through the skin." Water-dressing is applied. And "the success of this operation depends in a great measure on the edges of the incision being prevented from uniting by the first intention, particularly the horizontal incision upon the conjunctival surface. This is effected by everting the lid occasionally during the first few days, and by touching the edges immediately after the operation with the sulphate of copper, so as to cause them to suppurate and heal by granulation."* Another operation for entropion consists in making a perpendicular section of the lid, with scissors, at the external commissure alone or at each canthus, from a quarter to half an inch long; taking care not to wound the punctum. An elliptical portion of skin is then removed from the outer surface of the lid. Two or three ligatures having been introduced through the skin at the tarsal margin, the eyelid is everted by means of them, and drawn up towards the eyebrow; in which position it is retained for a few days, by the ligatures being fixed to the forehead with a strip of adhesive plaster. In the meantime, the exposed mucous membrane is covered with a piece of wetted lint; and as the perpendicular incisions heal by granulation, a sufficient degree of eversion will be produced.

Mr. Tyrrell recommended that the lid should be merely divided at its centre by a single perpendicular incision. The pressure caused by the contracted cartilage was thus relieved; and as the wound, shaped like an inverted Λ , healed by granulation, the margin of the lid was permitted to resume its normal position, and very little deformity resulted. These operations are only applicable to cases where the disease arises from a contracted state of the cartilage; and the first mentioned should be preferred in all cases where practicable.

Ectropion.

Ectropion denotes an opposite condition of the eyelid; its eversion; and is more frequently met with in the lower than in the upper lid. The conjunctival lining is exposed, the eyeball is partially denuded, and much deformity is produced. After a time, the exposed palpebral conjunctiva loses much of its membranous character; the surface of the eyeball becomes irritable and inflames, and the cornea undergoes change of structure—probably fatal to vision; while, if the lower lid is the one affected, a degree of epiphora invariably exists, in consequence of the natural course of the lachrymal secretion towards the puncta being interrupted. The mal-position most frequently results from contraction of cicatrices of the integument; and these may exist in the eyelid or its immediate vicinity, in the corresponding cheek, or extensively on the face or neck, as after severe burns. The cicatrix may follow a burn,

* Dublin Medical Press, July 27, 1842, p. 54.

wound, sloughing abscess, or exfoliation ; the first and last are the most unfavourable.

Ectropion, however, arises from other causes than the contraction of sores. Simple relaxation of the lower lid will produce it ; and this may depend on flabbiness and redundancy of all the component textures, or on atony only of the fibres of the orbicularis. The last circumstance is no uncommon occurrence in old people. Frequently, also, ectropion is caused by a faulty condition of the conjunctival lining of the lid ; which is the seat of swelling either of an acute or of a chronic kind. And



Fig. 240.

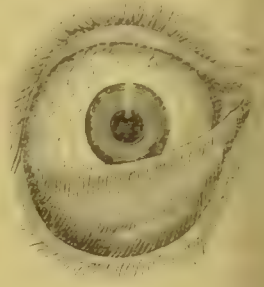


Fig. 241.

it is well to remember how general inflammatory swelling of the lid, along with contraction of the orbicularis, is able to cause either inversion or eversion, according to the accident of displacement ; just as a similar condition of the prepuce may be the cause either of phymosis or of paraphymosis. Eversion is no uncommon attendant on purulent ophthalmia from the acute and great swelling of the lid, more especially of its conjunctival lining. It also results from an indolent enlargement and thickening of that membrane, as in extreme cases of granular lids. The accidental division of either canthus, too, may cause it ; the lid becoming loose and pendulous. Or it may arise from an elongated and irregular state of the tarsal cartilage.

Treatment necessarily varies according to the nature of the cause. Acute swelling of the eyelid and its lining is subdued by the usual means. Chronic enlargement of the membrane is first treated by scarification, and astringents. If the punctum is displaced, and epiphora present, slitting up the canaliculus will often relieve the watering of the eye, and mitigate the inflammatory condition of the conjunctiva which produces the eversion. If these means be resisted, the redundancy may be removed by curved scissors ; great care being taken lest, by the removal of too much, entropion be produced. Atony or paralysis of the fibres of the orbicularis may be combated by the usual means ; but, generally, this form of the affection, occurring in those of advanced years, may be regarded simply as one of the many signs of decay—irremediable. When there is elongation of the tarsal cartilage, or redundancy of the whole lid, abbreviation, sufficient to restore normal position, is effected by a simple operation. Towards the centre of the lid, a triangular portion of its whole thickness is to be removed in the form of the letter V ; the margins of the wound

Fig. 240. Ectropion, affecting the upper eyelid ; the result of exfoliation.

Fig. 241. Ectropion, affecting the lower eyelid.

are brought together by suture, a proper compress is applied, and when the parts heal the lid will be in close apposition to the globe. In the case of faulty cicatrices, the procedure is more difficult and less promising. Occasionally, the simple division of a tight adhesion may suffice for liberation and replacement. But generally, there is loss of substance connected with the cicatrix, and consequently simple incision proves inadequate. In the case of a moderate cicatrix, at some distance from the ciliary margin, amendment, if not complete restoration, may be accomplished as follows: Supposing the lower eyelid to be effected, a V shaped incision is made, through the integument only, the apex pointing to the cheek. By means of a knife's point, the included skin is freed a little from its areolar connections; and resilience upwards is favoured by the necessary manipulation. Displacement upwards is then definitely secured, by bringing together laterally the wound that remains beneath, by means of sutures. In not a few cases, there is not sufficient laxity of parts to admit of this. Under such circumstances, something may be done by incising the eyelid, and replacing its ciliary margin; then filling up the chasm beneath, which necessarily results, by a flap of integument borrowed from the adjoining cheek, temple, or frontal region. When ectropion has resulted from accidental wound at the canthus, rectification is easily obtained by reunion of the divided parts; the margins of the cicatrized wound being made raw by paring, as in harelip, and retained in accurate apposition by suture. In cases where ectropion is produced by cicatricial puckering in connection with disease of the osseous walls of the orbit, the cicatricial contraction may be divided subcutaneously in many instances with good results.

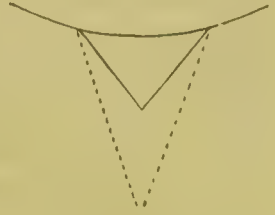


Fig. 242.

Blepharoplastics.

When either eyelid has been partially or totally destroyed, by injury, disease, or operation, an attempt may be made, not without good prospect of success, to supply the deficiency by a suitable flap brought from the immediate vicinity. No precise rules can be given for such an operation; the details must necessarily vary in each case.*

III. AFFECTIONS OF THE LACHRYMAL APPARATUS.

Epiphora. Stillicidium Lachrymarum.

Epiphora, or watery eye, is in the strict use of the term due to an increased secretion of tears, which stand in the inner canthus, or flow over the cheek; while *stillicidium lachrymarum* depends on some affection of the excreting lachrymatory apparatus, which prevents them from taking

* London and Edinburgh Monthly Journal, 1843, p. 359. Cyclopædia of Practical Surgery. *Sub voce.*

Fig. 242. Plan of this operation; the dotted line marking the original wound; the plain line representing the flap of skin in its new and elevated position.

up the tears as they are secreted. *Epiphora* is, however, at the present day usually employed to designate both conditions, without consideration of their cause.

The watery eye may be either congenital, or the result of injury or disease. It is best treated when due to lachrymal or conjunctival irritation by means of sedative and astringent collyria ; by weak solutions of nitrate of silver, or of wine of opium or of atropine, dropped upon the eye once a day ; or by exposing the eye to the vapour of laudanum, or bathing it with a weak belladonna lotion ; using, at the same time, some oxide of zinc or weak red precipitate ointment to the edges of the lids at night, when there is any derangement of the Meibomian secretion.

In all cases, not prominently connected with some more important affection of the eye, the state of the general system must be carefully looked to ; for it is extremely probable that no slight declension from health will be found ; and, unless this be remedied, all local treatment will prove of comparatively little avail. Sometimes the affection is caused by a detached eyelash getting into one of the canaliculi, and blocking up the punctum, while its protruding end irritates the conjunctiva. Often the watery eye is but a symptom of general ophthalmia, and only to be cured by its subjugation. When it results from a contracted or displaced condition of the puncta, or obstruction in the canaliculi, these conditions are to be treated by passing a fine grooved probe director by the inferior punctum along the canaliculus into the sac, and slitting in the conjunctival aspect of the lid by running a suitable knife along the groove. This plan of treatment was first introduced by Mr. Bowman in 1851, and has completely superseded every other method previously employed, in the treatment of affections of the lachrymal excretory apparatus. When there is relaxation or atony of the lachrymal sac, the stimulating collyria are to be used. Occasionally, a small blister applied over the sac is of use. When the nasal duct is obstructed, measures must be taken to effect its clearance. By passing probes of graduated size along the slit-up canaliculus into the sac, and then turning their direction downwards, inwards, and backwards, the probe glides through the sac down the duct, and into the floor of the nostril.

Xeroma denotes an opposite condition ; a dryness of the eye, dependent on deficiency, or entire absence, of the lachrymal secretion. Frequently it is a temporary prelude to graver affections of the eye, of an inflammatory nature. When it occurs singly, and persists—as is but seldom—restoration of the secretion is to be courted by ordinary stimulant means ; or glycerine diluted with water may be employed to supply the want. In congenital cases, the surface of the eye becomes a part of the general cutaneous surface, and is covered with a vascular structure resembling in appearance the *membrana nictitans* of the bird.

Inflammatory Affections of the Lachrymal Sac.

The areolar tissue over the lachrymal sac sometimes is the seat of inflammatory process ; while, in the first instance, the sac itself is free. A red, itchy, painful swelling exists at the corner of the eye ; and the system sympathises slightly. The cause usually is exposure to cold.

Purging, with low diet, and hot fomentation, followed up by the superficial application of nitrate of silver, or tincture of iodine, will ordinarily suffice to obtain resolution. If the symptoms are more acute, then leeching must be had recourse to; the leeches being applied over the part itself. If suppuration should occur, a very early incision should be practised at the most prominent point of the swelling. Not unfrequently the sac is involved, and suppurates acutely.

The *Lachrymal Sac* may itself be the primary seat of an acute inflammatory process. This may occur idiopathically in those of weak system; or in any one, after exposure to cold; or it may be superinduced upon chronic affection of the sac and nasal duct. A small, hard, circumscribed, and very painful swelling is formed below the tendon of the orbicularis muscle; the superimposed integuments soon become red; the eyelids are more or less cedematous: the corresponding side of the nostril is dry; and the system sympathises considerably. The swelling increases, often almost obscuring the eye; and severe headach usually is complained of. The course of the tears is obstructed, by the tumid state of the duct's lining membrane—the inflammatory condition having extended to it—and they find their way over the cheek. Suppuration occurs; and, sooner or later, the matter is discharged externally. Then a slow recovery may ensue; the nasal duct becomes again open, the tears resume their proper course, the suppurated aperture granulates and heals. Or the obstruction in the nasal duct remains, the tears do not reach their wonted outlet, the aperture contracts but does not heal; and the condition of *fistula lachrymalis* is established. In some cases the disease obviously commences in the periosteum or bone.

Leeches over the inflamed sac, warm anodyne fomentations, and water-dressing—with a full dose of morphia at night, to allay pain and procure rest—ought to be used early, to avert suppuration if possible. The occurrence of this is known not merely from the fluctuation of the swelling, but from the escape of a mucopurulent fluid from one or both puncta, when firm pressure is made over the swollen sac. When matter has formed, it must be evacuated. This is usually done by introducing a bistoury into the sac, below the tendon of the orbicularis, which ought, if possible, to be rendered prominent by drawing the lids outwards; but the cedematous swelling of the lids and inner canthus usually prevents this being successfully effected. The opening is then made where the swelling is greatest, and tends to point. A very much better plan, however, is to open the sac, by slitting up the punctum and canaliculus of the lower lid upon the grooved probe; and if the swelling makes the introduction of this instrument impossible, the lower lid should be forcibly everted and the sac opened by an incision on the inner side of the lid, beneath the caruncle—carrying the knife in a direction downwards and inwards. After evacuation, light water-dressing is applied; and the sac, after a time, may be occasionally syringed with warm water. Or an astringent lotion, or a few drops of nitrate of silver solution, may be instilled into the eye every second or third day. The remedial agent finds its way to the sac through the canaliculus, and acts quite as efficiently as the more troublesome and formidable use of the syringe. We hope that the membrane of the duct will duly recover from its tumid

state, that the natural course of the lachrymal fluids will be restored, and that the outward opening (*fistula lachrymalis*) in the sac will close.

Mucocoele, a chronic inflammatory affection of the lachrymal sac, is not uncommon; the process reaching no higher than congestion, with hypersecretion, and limited almost entirely to the lining membrane. An indolent swelling occurs beneath the tendon of the orbicularis, soft, fluctuating, comparatively painless, and capable of being emptied by pressure; for the puncta remain open, and through them the mucous, milky, or puriform secretion escapes upwards. The passage downwards is usually obstructed; and, indeed, this circumstance seems in most cases to be the origin of the malady.

Sometimes this chronic distension of the sac is the result of an acute or subacute inflammatory attack of its mucous membrane. In other cases, it is chronic from the first, and due to disease of the bone, of the periosteum, or of the mucous lining of the sac itself; and in these, the state of the general system is usually unsatisfactory. There is a constant liability to acute accession, from but slight causes; and when such an aggravation does occur, the progress is likely to be rapid and untoward. Suppuration and outward discharge take place; and *fistula lachrymalis* is established, complicated perhaps with necrosis of the os unguis.

Treatment consists in prophylactic care, so as to avert such untoward events; in attention to the general health; in maintaining a comparatively empty state of the sac, by occasional pressure; and in the use of stimulant collyria, or ointments. Sometimes vesication over the sac, by nitrate of silver or tincture of iodine, is of use; at other times, the application of a few leeches will prove serviceable.

It is in such cases that slitting up the canaliculus into the sac, so as to provide a free regurgitant escape for the collected fluid, and a suitable opening for the passage of probes from above downwards through the contracted nasal duct, is found to afford immediate and permanent relief. For overcoming structural obstruction in the nasal duct, any injection of the sac through the punctum is quite ineffective.

Fistula Lachrymalis.

How this condition is produced, has already been explained. Obstruction takes place in the nasal duct; the lachrymal sac inflames, suppurates, and ulcerates—the ulcerated aperture discharging externally; and the wound, only contracting, does not heal. This train of events may originate in the lachrymal passages, and usually does so. But the origin may be in the subcutaneous areolar tissue, as already stated; or in the bone and periosteum, in connection with a syphilitic taint of system. The




Fig. 243.

greater number of cases, however, are of a simple nature; originating in the lachrymal passages; and seldom involving the deeper parts.

Fig. 243. *Fistula lachrymalis*. The chronic stage established; and the aperture small.

The essential parts of the disease are, obstruction in the nasal duct, and an external opening overlying and communicating with the lachrymal sac. In treatment it is our object to close the opening; and that can be done only by removing the cause of obstruction. To this end, an operation is necessary. And till very lately the following was always performed:—The patient having been seated on a chair, with the head supported, a narrow sharp-pointed straight bistoury was inserted into the fistulous opening beneath the orbicularis tendon; and not only lodged in the sac, but pushed into the osseous nasal canal as well. To accomplish this dexterously, reference to the anatomy of the parts was necessary, in order that the penetrating instrument might receive the requisite direction; downwards, a little backwards, and a very little inwards. By the side of the bistoury a stout probe was passed down; and as the former was slowly withdrawn, the latter was pushed steadily onwards, until it had overcome the obstruction, and was felt to touch the floor of the nasal fossa. To effect this perforation, a little force was sometimes necessary. A few drops of blood, escaped by the nostril, and proved re-establishment of the duct complete; also, if the patient was made to expire forcibly, while the nostrils were shut, air and bloody mucus would be forced upwards through the duct, if the probe had been withdrawn.

But it was not enough that the knife and probe procured a temporary re-establishment of the canal. This had to be kept permanently open.



And to accomplish this, *styles*—or small bougies—were employed; of various sizes, and made of silver. One about the thickness of an ordinary probe, and sufficiently long to reach from the upper wound to the nasal aperture of the duct, but not so long as to rest on the floor of the nostril, was lodged in the canal; its flattened head resting on the integument. No fixed size could be defined as generally suitable for the commencement of the treatment. The style had to pass easily, after withdrawal of the ordinary probe. Having been lodged, it was left there. After some hours, the part usually became hot, painful, and swollen; still, the style was left untouched. Fomentation, or water-dressing was applied, and the minor general antiphlogistics employed; and after a day or two, when the inflammatory signs had subsided, the style became loosened, and pus escaped by its side. After a few days of quietude, the original style was withdrawn, a size larger was substituted. This, in its turn, was replaced by a third; and so on; until one was lodged of sufficient bulk completely to occupy the canal; the passage being syringed once a day with tepid water, to keep it clean. This last style was worn for some considerable time, until it was presumed that the normal calibre of the passage was fully restored, and that its lining membrane had returned to a tolerably sound condition. Then the instrument—which had only been taken out occasionally, for the purpose of being cleaned and replaced—was withdrawn, and a smaller substituted. This, after having been worn for some days, was replaced by a less; and by this gradual abstraction of the stimulus, relapse was prevented as far as possible. Then, if the tears continued to flow naturally, and all else

Fig. 244.

Fig. 244. Style for the lachrymal duct.

seemed favourable, the use of the instrument was wholly abandoned; and the external aperture, now much contracted, was permitted and encouraged to close entirely. Frequently no aid was required to secure this latter event. But if the fistula threatened to prove obstinate, the touch of a heated wire, or point of caustic, usually effected its contraction and closure.

At one time, tubes were employed instead of styles. Experience, however, proved them to be inferior. They created the same disturbance in the part, were apt to become obstructed, equally required occasional removal, and, in some cases, their attempted removal was attended with the utmost difficulty.

But now-a-days all these tedious and painful proceedings have been superseded by the simple and efficient procedure of Mr. Bowman, to which we have already so frequently in this chapter had occasion to allude. In performing it, the operator must bear in mind the relative position and direction of the puncta, canaliculi, sac, and nasal duct. The patient to be operated upon may either sit or lie, the operator may either be seated in front or stand behind, and the patient's head should be steadied; the operator everts the angular edge of the lower lid, close to the inner canthus; recognising the little punctum on its apex, he passes the point of the grooved probe (made for this purpose) perpendicularly into the canaliculus; then, stretching the margin of the lid outwards, by the fingers of his own or of an assistant's hand, he directs the point of the probe inwards towards the sac, gliding it smoothly onwards. If it is obstructed at the entrance into the sac, it drags upon the lid, and puckers the integument along the line of the tendo oculi. Passed into the sac, it impinges against the *os unguis*, which is recognised by the sensation of firm resistance, and by the depth to which the probe-director's point has sunk in the canal. The groove should now be turned towards the conjunctival aspect of the lid; and by running a sharp-pointed, thin bladed knife along the groove, the canaliculus is converted into a slit, and the sac is freely opened. Should the obstruction be due to the condition of the punctum, canal, or sac, this incision must be prevented from healing; and there is no further operation needed, the lachrymal fistula healing spontaneously; but should an obstruction exist in the nasal duct, further treatment of that condition will be required. When the constriction exists in the canaliculus close to the sac, it has been recommended that a canula with a sliding lancet blade should be employed for the division of the constriction. But this is quite unnecessary; the grooved probe, if fine enough in the point, will readily permeate the stricture, by a little careful manipulation; and if the knife employed is fine enough to slide easily in the groove, the constriction can be more certainly divided by means of it than by any ingenious arrangement of mechanical device.

At one time it was a common practice to seek a more direct road to the nasal fossa, than through the obstructed lachrymal duct, by perforation of the *os unguis*. This destruction of unimplicated texture, however, is in the present day very properly deemed unwarrantable, except in cases of congenital absence, or osseous occlusion, of the nasal duct.

If necrosis accompany the condition of fistula lachrymalis, exfoliation

must be patiently awaited ; for not until the dead portion of bone has been thrown off, can the soft parts be expected to heal. At the same time, constitutional treatment will certainly be necessary. The bone is often, however, felt to be denuded without any dead portion separating.

It is well to remember that affections of the lachrymal sac may be simulated, tolerably closely, by malignant disease. A medullary tumour, or a malignant polypus, formed in connection with the nasal passages, may project towards the surface at the inner angle of the eye ; and its first prominence, yet covered by the stretched and attenuated integument, may occupy the exact locality of the lachrymal sac. But a touch of the part will evince elasticity instead of fluctuation ; a glance at the nostrils will shew the true seat of the disease ; and the cachectic face and general appearance will sufficiently testify to the malignant character. Both conditions, however, may coexist.

Obstruction of the Nasal Duct.

We can readily understand how this should be a not unfrequent result of an inflammatory process in the lining membrane. The membrane is at first turgid by soft swelling ; and this narrows, and may obstruct, the canal. Such obstruction is temporary in its nature, and capable of yielding to ordinary treatment, whereby absorption of extraneous product may be obtained. But if the process continue, the inflammatory change becomes more and more dense, and more enduring ; partly mucous in its site, but chiefly submucous ; and by continuance or aggravation of such structural alteration, diminution and obstruction of the canal are rendered plainly inevitable.

For the minor form of obstruction, rectification of the general health, counter-irritation applied over the part, and the use of sorbefacient collyria or injections, may suffice. In the more advanced form, the stimulus of the lodgment of a foreign substance in the part is essential to efficient restoration by absorption. Formerly this indication was fulfilled, by passing a probe upwards, from the nasal orifice of the duct. The probe, *Gensoul's*, bent nearly to a right angle, at about three-fourths of an inch from its point, was passed carefully along the inferior meatus of the nostril, until it arrived below the anterior extremity of the inferior turbinated bone ; then its point was directed upwards, into the canal. This manipulation, always doubtful in the first instance, on account of the valvular protection by which the nasal orifice of the duct is guarded, and which must be forcibly broken up—and which often proved most difficult to the surgeon, and both teasing and painful to the patient—not unfrequently failed altogether. Now-a-days it need never be attempted : in all cases of obstruction in the nasal duct, it being better at once to have recourse to the same treatment as for fistula lachrymalis—viz., to open the sac by Mr. Bowman's method, and then to proceed with gradual dilatation of the nasal duct ; passing probes of different sizes along the slit formed by cutting up the canaliculus into the sac. When the probe is felt to impinge upon the os unguis, by carrying the hand upwards so as to bring the instrument into the axis of the duct, its point will glide down into the nostril, with the employment of gentle pressure and a

slight rotatory motion. The passage of the instrument is rendered more easy, if its extremity is slightly twisted so as to make it spiral. These probes, or bougies as they may be called, are of different thicknesses, and six different sizes are usually supplied in a set. Two sizes, however, are all that is essential in addition to the grooved steel probe, in most cases. The passing of the instrument is usually attended with the escape of a few drops of blood from the nostril, which is unimportant, and ceases to be observed when dilatation has become permanently established.

Obliteration and Absence of the Nasal Duct.

1. The nasal duct may be obliterated by change of structure in the membrane. Restoration by perforation may be attempted. 2. It may be shut up entirely by change of structure in the bone. Then restoration in the original site is hopeless; and if anything remedial is undertaken, it can only be by perforating the os unguis, and rendering the unnatural aperture permanent.

A case is related by M. Berard, of congenital absence of the nasal duct; from which there had resulted a congenital fistula, which continued open and discharging at the age of twenty-one. An artificial outlet was formed for the secretion, by perforation of the os unguis.*

Dacryolithes.

Concretions are sometimes found in the lachrymal passages; mainly lodged in the sac; and consisting chiefly of carbonate of lime, cemented together by mucous and albuminous matter. The foreign substance produces swelling and lachrymation, and may ultimately cause fistula. Its presence is easily detected by manipulation, and by the introduction of probe through one of the puncta. The remedy is simple; incision of the canaliculus and sac, and removal of the mass. Sometimes they have been met with attaining a very large size, occupying the lachrymal sac and duct, producing absorption of the bone and ulceration of the soft parts, attended by a dense diffuse swelling of the cheek, and simulating malignant disease.

Affections of the Lachrymal Gland.

Dacryadenitis.—The lachrymal gland may be the seat of an inflammatory process, chronic or acute; but either form of attack is rare. A painful swelling forms in the region of the organ; the eyeball is displaced, and inconvenienced in function and movements. The eyelids are cedematous; and the conjunctiva is apt to sympathise and take part in the morbid process. In the acute form, the system suffers severely; the pain grows intense and shoots through the head; and suppuration may take place. When the matter is discharged spontaneously through the eyelid a fistulous aperture sometimes remains.

The treatment is according to general antiphlogistic principles. When matter forms, an early and free opening is to be made from the inside of the lid if possible.

* British and Foreign Review, No. 24, p. 541.

Atrophy of the Lachrymal Gland may take place, but this is very rare; the organ ultimately becoming almost effaced. Then either xeroma results; or the conjunctival secretion is augmented, to atone for the glandular deficiency.

Tumours of various kinds may form in the substance of the gland. It is liable to simple hypertrophy; amenable to discutients. Sometimes it is the seat of cystic formation; remediable by simple puncture—or, if that fails, by injection or excision. The secretion of some portion of the lachrymal gland may cause obstruction of one of the ducts; becoming collected in quantity, dilating the duct, and giving rise to the formation of a cystic tumour called *Dacryops*, which projects through the upper lid. By widely opening the eye, or, still better, by everting the lid, the margin of the cyst may be seen to project from beneath it. All that is needed seems to be to seize this with catch-forceps, and clip away as much of the cyst-wall as can be easily removed; the after-employment of a stimulating collyrium, or solution of nitrate of silver, will very speedily restore the parts to their normal condition. Carcinoma may attack the gland. There is obviously no hope but from early removal. The extirpation should be effected by an incision beneath the eyebrow, along the margin of the outer part of the frontal portion of the orbit. The fascia of the orbit having been divided along the whole extent of the incision, the gland should be separated by the finger or the handle of the knife, from the roof of the orbit. A sharp hook, or volsella, should then be fixed in its substance; and as it is drawn out through the wound, the adhesions it has formed to the surrounding contents of the orbit should be divided as they are brought into view. In doing this, the *levator palpebræ* muscle must be avoided. When the bleeding has ceased, the incision should be closed with points of suture, and a pad placed over the closed lids. This is secured by means of a bandage, to maintain the globe repressed, and the contents of the orbit in contact with its upper wall—a vacant space else existing where the tumour was situated. If suppuration occur, the sutures should be removed at the outer angle; and, if the matter collects in the deep part of the wound, either the incision should be extended outwards and downwards, or the matter should be afforded a free vent by a fresh puncture from the conjunctival aspect of the upper lid.

Encanthis.

By this term is meant an enlargement of the caruncula lachrymalis; may be a simple and somewhat acute enlargement of the part, the result of an inflammatory process resident therein. This will readily give way to ordinary treatment—scarification, or leeching, fomentation, and refacients.

A chronic swelling, of the nature of hypertrophy or simple tumour, or polypoid excrescence, may occur; less amenable to discussion, and often resisting it.



Fig. 245.

Fig. 245. Encanthis.

It slowly increases; producing deformity by its prominence and bulk displacing and obstructing the puncta and lachrymal canals, whence troublesome lachrymation results; preventing due closure of the eyelids; and favouring the occurrence of ophthalmia. This idiopathic affection is closely simulated by the warty outgrowth of weak granulations from the incision practised in the conjunctiva, in the operation for strabismus. In either affection, if discutients fail, excision is to be practised, by means of curved scissors, the growth being drawn outward by artery forceps.

Sometimes the caruncle is the seat of tumour of a malignant, or at least suspicious character. Then it usually presents the appearance of epithelial cancer. In such a case only by early as well as free removal can immunity from return be hoped for. Should the disease unfortunately return after removal, and the ocular conjunctiva be implicated, the globe as well as the diseased structure should be removed together.

IV. AFFECTIONS OF THE EYEBALL.*

Ophthalmia.

Ophthalmia is the general term, in which all affections of the eye of an inflammatory nature are comprehended; and, according as the superficial or more deeply-seated textures are involved, the ophthalmia is said to be External or Internal.

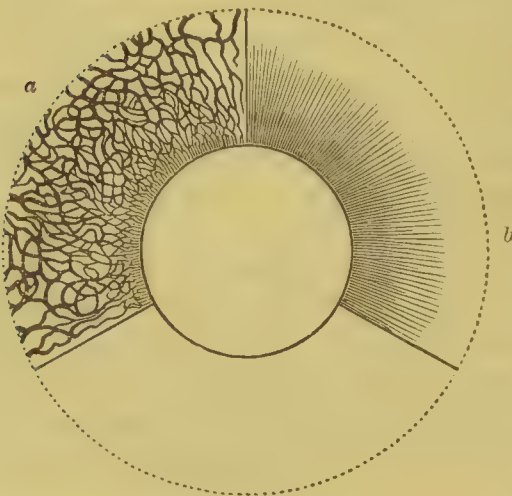


Fig. 246.

Affections of the Conjunctiva

The inflammatory process, in its grades, is very frequently first established in the conjunctiva; the affection varies materially, only according to the intensity of the process itself, but also according to the cause which induced it, and the state of the system in which it has occurred. Different varieties of the disease may in consequence be enumerated. The most prominent of these are the *Simple* or *Catarrhal*, the *Purulent*, and the *Phlyctenular*.

to the cause which induced it, and the state of the system in which it has occurred. Different varieties of the disease may in consequence be enumerated. The most prominent of these are the *Simple* or *Catarrhal*, the *Purulent*, and the *Phlyctenular*.

* In such a work as this, it is not to be expected that so wide a subject as the affections of the eyeball—so important, varied, and numerous—should be fully discussed in all its details. The leading points only can be overtaken; the student is referred for further information to the many excellent monographs in this department of Surgery.

Fig. 246. Diagram shewing the characteristic vascularity of external and internal ophthalmia. *a*, external; *b*, internal.—W. JONES.

Simple or Catarrhal Conjunctivitis.

The eye becomes the seat of pain, heat, and lachrymation ; there is intolerance of light, and consequent closure of the eyelids—more or less spasmodic ; frequently there is a sensation as if sand or other foreign matter were lodged in the part. On separating the eyelids, the membrane is seen to present an appearance of unusual vascularity ; not from formation of new vessels, but from enlargement of those already there. It is important to remember that these vessels have a peculiar character, whereby affection of this membrane may be distinguished from the affections of more deeply seated parts. The vessels are of considerable size, they seem to advance from the periphery of the globe, where the membrane is reflected from off the palpebrae, are tortuous in their course, freely inosculate with each other, and terminate gradually at the margin of the cornea ; they are also observed to follow the movements of the membrane ; sometimes they are distinct and separate, because not very numerous ; sometimes they are numberless, constituting one mass of angry red ; and the redness is usually of a bright scarlet hue, most intense on the inside of the lids at the reflection of the conjunctiva upon the globe. Whereas, in sele-

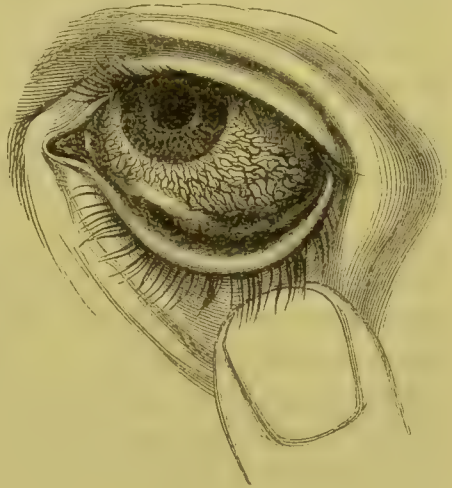


Fig. 247.

rotitis, the vessels are small, straight, not affected by the movements of the eyeball, appear first near the margin of the cornea, become paler towards the periphery of the globe, do not inosculate, plainly occupy deeper plane, and cause a redness of a pink or purplish hue (Fig. 246).

In what is strictly termed Simple or Catarrhal Conjunctivitis, the range of the inflammatory process does not reach higher than that characterised by active congestion, attended with sero-fibrinous accumulation in the subconjunctival tissue, swelling of the lids, and profuse mucous and lachrymal secretion. Still, in characteristic specimens of the affection, the existence of numerous small red blotches of extravasation may be observed ; these blotches varying in size from a pin head up to a continuous patch, covering, it may be, a quarter or even the whole of the white of the eye—produced by the giving way of one or more distended vessels. In some cases, usually called catarrho-rheumatic, the sclerotic is involved at the same time ; and then the tortuous conjunctival vessels are combined with, and tend to obscure, the pink zone surrounding the cornea. In these cases, there is more pain, in the eye and around the orbit, more intolerance of light, and a more copious lachrymation.

The system may be sympathetically involved ; but, in general, its disturbance is neither prominent nor severe, and is confined to disorder of the stomach and bowels.

Fig. 247. External ophthalmia ; catarrhal conjunctivitis.

The disease may occur *per se*; or be but a part of a more general inflammatory attack; as in measles and coryza.

The predisposing causes are numerous: over exertion of the organ in many ways; derangement of the general health; a glaring, sunny, or dusty season. The exciting causes are equally numerous: exposure to cold, heat, wind, light, or moisture; the application of chemical and mechanical irritants, directly; and the indirect influence of irritant causes more remotely. The most obstinate forms of the disease are to be expected, when the exciting cause is by a direct irritant which remains in constant operation; as when a particle of sand, dust, or glass, lodges in the membrane, or when it is constantly rubbed or fretted by stray eyelashes, or by a foreign body lodged in a punctum, or by a Meibomian follicle.

In the treatment, our first care is to remove the cause. Then antiphlogistics are to be used; but these need be only of the mildest class. If the cause—as a foreign substance lodged in the membrane—have been removed at once, nothing may be required in addition to rest of both body and part, low diet, abstraction of light, and continuous application of cold over the shut eyelids by means of wetted lint. The inflammatory process may be entirely averted; or, if just begun, it may very speedily resolve. If not, then, when the symptoms are very acute, blood may be abstracted locally, by the application of two or three leeches at most, in the neighbourhood of the eye itself. Care should be taken that all the animals fasten near the inner angle only, immediately beneath the tendon of the orbicularis; for there less pain will be occasioned, more blood will be drawn, and less risk both of ecchymosis and of œdema will be incurred, than when they are applied along the eyelids. Leeching is, however, rarely required, and warm fomentation of the lids with a weak belladonna lotion, mixed with an equal quantity of boiling water so as to make it of the required temperature, will usually suffice to allay the painful symptoms. When copious mucous secretion agglutinates the lids, any simple ointment applied along the margins will prevent adhesion, and save both pain and trouble in removing the crusts.

The process may simply and steadily resolve; or may pass from the acute to the chronic condition, and there tend to remain. It is to be borne in mind, that in all cases of this affection, especially in young and feeble individuals, the chronic state, differing little from that of mere passive congestion, is very apt to be assumed at an early period—after the lapse of but a few days. Then, continuance of antiphlogistics would but aggravate the morbid condition. A change has to be made. Gentle stimulating collyria are employed, to restore tone to the vessels. Solutions of lead, alum, or of tannin, may be employed; but usually the occasional introduction of a few drops of a solution of nitrate of silver (of the strength of two grains of the salt to the ounce of distilled water) within the lids, will be found best suited to check the continuance of the disease. In some cases the *vinum opii* will be found to answer better. During recovery, air and light should not be excluded; and while all glare is avoided, coverings to the eyes, preserves, etc., should be forbidden. This stimulating plan of treatment, however, is qu

unsuitable when the sclerotic and cornea are involved; and it is from inattention to this that much harm is sometimes done by the careless use of such appliances. In those cases in which amendment is tardy or fluctuating, it is well to adopt the aid of counter-irritation; which is best applied by blistering, behind the ear.

Constitutional treatment is not to be neglected during any period of the case; first moderately antiphlogistic, then alterative, and ultimately tonic.

When one eye only is affected, it is well to remember the close sympathy which exists between the two organs. The unaffected eye, therefore, should, during the acute stage, be kept equally quiet and shaded from the light, and otherwise treated with prophylactic care. Confinement to a dark room is not generally necessary however; and when the case is chronic, free exposure of the organ to the open air will often prove beneficial.

Purulent Conjunctivitis.

Purulent ophthalmia seems to be merely an aggravated form of catarrhal conjunctivitis; running its course, however, much more rapidly; and mainly distinguished from the latter, in its mild form, by the discharge being purulent instead of muco-purulent, and from the fact that the cornea is more liable to become involved. When purulent discharge occurs in the simple form, an aggravation of the inflammatory process having been somehow induced, such a circumstance is to be regarded as an accidental intensity in acute simple conjunctivitis, rather than as an example of true purulent ophthalmia. Usually, the inflammatory process is from the first intense, and suppuration is very speedily attained. The first symptoms are pain and itching in the palpebral conjunctiva, and often there is a sensation as if foreign matter were lodged there. Then the ordinary characters of conjunctivitis appear, in an aggravated form. The pain is not confined to the eye, but shoots through the head, and not unfrequently extends to the face also. The eyeball becomes quickly covered with meshes of enlarged conjunctival vessels; the membrane itself is infiltrated and tumid; a profuse purulent secretion is poured out; the eyelids are swollen, and œdematous, often to a great extent; ordinarily, the eyeball is concealed by the tumid lids; on opening them forcibly, purulent matter escapes in increased quantity, and eversion is apt to ensue—the engorged and red conjunctiva becoming exposed.

As the disease advances, the conjunctival lining of the eyelids, more especially of the upper, changes from the uniform, vascular, and villous appearance, to one of more irregularity, as if granulating. The conjunctiva is then said to be *granular*. This term, however, does not imply that the membrane becomes actually studded with true granulations; the fleshy elevations being developments of the natural papillæ and follicles. These continue to furnish a profuse discharge; and the friction of them over the ocular conjunctiva doubtless maintains the general morbid condition.

The ocular conjunctiva, it has been already said, undergoes change of structure. Sero-fibrinous product and extravasation collect both in

and beneath it ; when considerable causing it to bulge over the margin of the cornea, and leaving that texture in the relative position of a depression or dimple. This tumid state of the conjunctiva is termed *Chemosis*. When the affection is acute, and the chemosis great, the cornea is in danger of sloughing ; partly from its participation in the inflammatory change, and partly by the circumferential ulceration of its structures, where it is concealed by the surrounding chemosis, thinning the margins through which its nutrition is maintained.

The system sympathises to a great extent. At first inflammatory fever is developed. Afterwards, the form of Constitutional Irritation is often assumed ; and in many cases the pale face, trembling hands, deranged digestion, and feeble pulse, indicate a degree of prostration which, though constantly present when the disease is seen in an advanced stage, may manifest itself from the very commencement. Vision is in imminent danger, by change of structure in the cornea, and also by disorganization of the entire globe ; for to the latter result this affection may advance, under circumstances of either neglect or severity.

In Egypt the disease prevails as an epidemic, and has done so for ages ; of the most virulent and intractable form ; very fatal to sight originally induced by sun and sand ; and propagated, also, by direct contagion. In effecting reproduction by the latter mode, the flies are said to be active agents—passing from one eye to another, tainted with the contagious matter. In this country, it is happily both less frequent and less severe. It may follow injury ; and then the purulent discharge to be looked on as the mere consequence of a high amount of inflammatory progress, induced by a powerful exciting cause. Want of cleanliness, of good drainage, and of ventilation, and the over-crowding of inmates—as in schools and barracks, and on board of ship—predispose to the production of this form of disease, under the influence of a comparatively slight exciting cause. Thus occasioned, it is undoubtedly contagious ; the matter of one patient applied to the sound conjunctiva of another being capable of inducing a similar affection. And when many patients happen to be crowded together, without due cleanliness and ventilation, there is good reason to believe that the infectious character is also acquired.

Treatment, in energy and promptitude unequalled in any other affection, used to be employed in these cases. For this disease, or the mere suspicion of it, blood-letting was practised without regard to consequences. “Bleed so long as blood can be drawn. The lancet must never be out of reach if you would save your patient’s sight.” Such were the dicta of our immediate predecessors. “The *only case* of gonorrhoeal ophthalmia,” says a distinguished writer, “which I have seen in which the eye was saved, was that of a young woman in whom venesection was repeated as often as blood could be got from the arm. She lost 16 ounces in a few days, and looked as if every drop of blood had been drained from her body, the skin having nearly the hue of a wax candle. Purgatives, emetics, salivation, and starvation were strenuously advocated too, as essential if we would save the eye.

Now-a-days things are very different, and results are more satisfactory. Leeches even are rarely needed ; of use only at the very outset, and with

circumorbital pain indicates the complication of inflammatory progress in the deeper textures of the eyeball. Usually local applications are alone required; and of these nitrate of silver is unequalled in efficacy. By some this is applied by everting the lids, and pencilling the solid caustic over the villous congested surface; using a stream of tepid water to wash away the purulent matter before the application, and to remove the redundant caustic after it has been employed. This, however, except in experienced hands, is apt to do more than is desired. Instead, a solution of two, three, or four grains to the ounce of distilled water should be dropped upon the surface of the globe, after the purulent secretion has been carefully removed by washing. This application, when the secretion is very copious, may be made every three or four hours during the day; but as it requires the assistance of some one accustomed to open the lids and apply it, some astringent lotion may be used instead. This should be applied with a bit of rag, or even syringed within the lids—if the swelling renders this necessary. The astringents best suited for the purpose are alum or tannin, of the strength of two or three grains to the ounce, combined with belladonna, atropine, or morphia in solution, as the sensations of the patient may direct. In addition to this, opiates at night, good wholesome food, quinine and iron, and ultimately even stimulants, will often be found necessary. In cases where the chemosis is well marked, Mr. Tyrell recommended the use of incisions in the ocular conjunctiva, made in a direction radiating from the cornea, as a centre; his object being to relieve tension and the strangulation of the cornea, which he presumed was occasioned by the overlapping conjunctiva. The tension will be very much more satisfactorily relieved by clipping off a few of the most prominent elevations of the tumid membrane; thus affording a free escape for the serum collected in the meshes of the submucous tissue, and likewise enabling the surgeon to recognise the line of ulceration corresponding to the margin of the cornea. To this, whether the chemosed conjunctiva is divided or not, nitrate of silver should be applied by means of a fine probe, coated at the point, which may be rapidly run round the line of ulceration, while the lids are kept open by the fingers, or by a spring speculum. Again, when the friction of the lids against the cornea tends still more to increase its risk of destruction, very great relief will be afforded by puncturing the cornea in the line of ulceration, so as to evacuate the aqueous humour. This should always be done, when the ulcer is ready to perforate, and the pinned inner layer of its structure bulges outwards; for if it is not done when, prolapse of the iris, engagement of it in the ulcer, and adhesion of it there with displacement of the pupil, are almost certain to ensue when an opening spontaneously forms. Another fact, too, should be borne in mind, as indicating the propriety of such operative puncture; that, when the ulcer penetrates, the escape of the aqueous humour is generally attended by a complete relief from pain, and speedy amendment in all the symptoms. Uniformly has the same favourable result been found to follow the employment of operative puncture in these cases, especially when employed early, before the cornea has shewn any trace of haze; and it may be practised, therefore, with every confidence—all the more so as it checks the spread of ulceration, if commencing, and favours the

occurrence and completion of cicatrization. When the case is not seen until the swelling of the lids has become extreme, and it is difficult to separate them so as to catch a glimpse of the cornea within, the external commissure should be divided by means of a curved sharp-pointed knife, the point of the finger being employed as a guide to its point beneath the free margin of the lid. When the acute stage is past, astringents especially the drops of nitrate of silver, should be continued till the vascular structures regain their normal tone.

Throughout the whole treatment, it is essential that matter be not allowed to accumulate beneath the swollen and shut lids; these are to be gently opened from time to time, and the pus washed away by warm water.

It ought always to be borne in mind, also, that the discharge is of contagious nature; and the patient, practitioner, and attendants, should guard accordingly against direct propagation of the disease.

Such is the nature of the ordinary Purulent Ophthalmia. Two varieties of the disease require a separate though brief notice.

Ophthalmia Neonatorum.—By this term is understood Purulent Conjunctivitis occurring in the recently born child. It may be induced by mere want of cleanliness, by imprudent exposure of the delicate organs of sight to intense light, or by the direct application of other stimuli. But in most cases it owes its origin to contamination of the conjunctiva by vaginal secretion—during parturition. The disease presents its ordinary characters; and there is much risk of permanent loss of sight by pearly opacity of the cornea, or the formation of staphyloma.

The treatment is founded on the same principles as already enumerated. It is usually enough to employ simple ablution, frequently repeated—perhaps every second hour; and a weak solution of nitrate of silver is dropped into the eye, once a day, or oftener, as the copious flow of the secretion requires. Great attention to cleanliness is to be always maintained, and the eyelids should be prevented from adhering together by applying a little simple ointment to their edges at night. Attention is at the same time paid to the primæ viæ, and general system; iron tonics being invaluable in such cases.

As children have been born with opaque corneæ, it has been inferred that this disease may occur in utero. Such opacity, however, may be the result of mere arrest in development, or due to congenital syphilis.

Gonorrhœal Ophthalmia.—The application of recent gonorrhœal matter, from the urethra to the conjunctiva, produces the most intense form of purulent conjunctivitis. One eye ordinarily is affected; although it is seldom that both are inoculated at one time, double gonorrhœal ophthalmia is common enough; in this respect, therefore, we cannot establish a difference from the common purulent conjunctivitis. The dusky colour of the conjunctiva, the swelling of a pre-auricular lymphatic gland, and the primary implication of the ocular conjunctiva, have been spoken of as pathognomonic of the gonorrhœal form of purulent ophthalmia; but there are no sufficient facts in support of any of the differential characters, and a considerable experience of such cases leads me to the conviction that fallacy and fancy have had to do with the

assertion. While, then, I do not know of any symptom by which we can distinguish the ordinary purulent from the gonorrhœal ophthalmia, it is well to remember that gonorrhœal ophthalmia is rarely seen in females, and principally occurs in young males who are debilitated. In some cases the superficial conjunctivitis is apparently combined with a rheumatic affection of the Sclerotic and Iris.

Treatment is in no way peculiar ; proportioned in activity to that of the disorder, it is similar, in all respects, to that already recommended. Nitrate of silver in solution, with careful attention to cleanliness, and to the state of the cornea, constitute its essential indications.

Strumous, Scrofulous, Phlyctenular Ophthalmia.

This affection is essentially a disease of the cornea, of which the conjunctival congestion is only symptomatic. In addition to the ordinary traits of the strumous cachexy, it is characterised by remarkable photophobia, or intolerance of light—often quite disproportioned to any obvious symptom ; by enlarged vessels collected into fasciculi, which stretch from the corneal margin, and terminate in one or more small whitish elevations (pustules or phlyctenulæ) or in an ulcer ; by exacerbations occurring in the morning, while there are remissions at night—the opposite of what obtains in other ophthalmiæ. This leash of vessels is of all the other signs most characteristic of the disease. Sometimes the rest of the cornea is quite clear ; but when there are several spots or ulcers, a general corneal change of structure is extremely apt to ensue ; and in such cases more or less sclerotic congestion surrounds the cornea. The conjunctival congestion is confined for the most part to the larger venous trunks. The affection seldom occurs after puberty ; and prevails chiefly during childhood. At that age, the intolerance of light, with spasmodic closure of the eyelids and copious lachrymation, is certainly the most prominent symptom. The child keeps its hands pressed on the shut eyelids, and turns its face on the nurse's shoulder, or, if in bed, on the pillow, even in comparative darkness. In cases of long continuance, the edges of the lids become raw and excoriated ; and from the spasm of the orbicularis palpebrarum, are kept in an almost inverted condition, so that the eyelashes get under, and are there retained, augmenting the distress. The cheeks are scalded by the discharge which almost constantly wets them, and become covered with an angry eruption. The features are contorted ; and a confirmed expression of pain and discontent is assumed. On attempting to open the lids, much suffering is occasioned ; the lachrymation increases, the lids become more inverted, and the eyeball is rotated upwards and outwards so as to conceal the cornea. In such circumstances it will often be necessary, in order to obtain a good view of the eye, to separate the lids by means of the wire speculum.

The treatment consists in constitutional management, suited to this particular cachexy, conjoined with measures calculated to soothe the local irritation. This latter indication will best be fulfilled by bathing the eyes with warm water, medicated, if need be, with belladonna or opium. In some cases, smearing the lids with belladonna, or dropping a solution of atropine into the eye, answers even better. Counter-irrita-

tion to the temples or eyelids, by means of strong tincture of iodine or solution of nitrate of silver, should be employed and repeated from time to time, as the skin will bear it. Actual blistering of the temples, or behind the ear, is apt to do too much, and irritate the cervical glands. Leeching, purgation, or the use of nitrate of silver, dropped into the eye, should never be employed. Simple ointment smeared upon the lids and cheeks will relieve the excoriation. The constitutional treatment is most essential. Alterative laxatives, followed by henbane, to allay irritability. Cod-liver oil, or glycerine, as circumstances direct. But no medicine seems to act so beneficially as quinine, which often displays a decided influence in allaying the morbid sensibility, relieving the intolerance of light, and removing the inflammatory process. Preparations of iron, too, especially the tincture of the muriate, will be found invaluable; but the dose must be such as to produce no irritation, and should be given along with a copious draught of water after meals. The child should have a solid, nutritious, but easily digested diet; and should not be confined to the house, unless during cold and wet weather. In going out, the eyes should not be tied up, but freely exposed to air and light; the glare being relieved by a prominent, light, ventilating shade. A residence on the sea coast, with warm exposure, but without bathing in the sea, is also useful. In slight cases, a weak astringent lotion, containing tannin or lead, is all the treatment which is requisite. But lead should never be employed where an ulcer of the cornea exists.

Exanthematous Ophthalmia.

Accompanying or following measles, scarlatina, small-pox, eczema, erysipelas, various affections of the eye may occur. But in all of them when the inflammatory symptoms assume any grave importance, this is due to ulceration of the cornea. It is in scarlatina and small-pox that the most disastrous results are met with; sloughing of the entire cornea with disorganization of the eyeball sometimes taking place. This is due not to any specialty in the inflammatory process, but to the debility of constitution which accompanies and succeeds the attack. It was at one time supposed that the specks upon the cornea which resulted in these cases were due to the occurrence of the eruption upon the cornea. Mr Marson, in 1839, satisfactorily shewed that in the case of small-pox, at all events, no pustules formed in this situation. The treatment of these cases should be that of acute ulceration of the cornea.

Granular Conjunctiva.

The granular condition, dependent on a hypertrophied state of the papillæ and mucous follicles of the palpebral conjunctiva, has been already noticed—as constituting an important integral part of badly treated or neglected purulent conjunctivitis. But a similar change of structure may occur, quite independently of this latter disease. It may be the result of a chronic inflammatory process resident in the palpebral membrane; and this will frequently be found to have been produced by the use of irritating applications, either by ignorant practitioners, or

obtained in the form of ointment as a quack remedy. At first, doubtless, there is mere enlargement of the normal structure ; but, after a time, this is more or less altered by continuance of plastic product ; the surface becoming dense as well as prominent, rough, irregular, and sometimes fissured. The upper eyelid is more prone to suffer than the lower.

It can be readily understood how such a structure, at each movement of the lid, must greatly fret the ocular conjunctiva ; causing an irritation there sufficient to light up the inflammatory process, and more than sufficient to maintain an affection which has been already established. To remove the alteration of structure, therefore, becomes a most important therapeutic indication. It used to be the recognised plan of treatment to cut away these hypertrophied elevations, or to attempt to destroy their undue vitality by the application of nitrate of silver, or sulphate of copper, in the solid form. Such measures never did any permanent good, and often made matters worse than before, producing incurvation of the lids, and opacities of the cornea of a most obstinate kind. Now-a-days the following applications are all that are employed :—1st.

Dusting on acetate of lead, in fine powder, into the interstices of the granulations ; 2d. Painting on the surface of the everted lid a solution of the acetate of lead ; and, 3d. Applying the undiluted liquor potassæ, in the same manner, to the granular surface ; 4th, Inoculating the conjunctival surface with gonorrhœal matter, so as to set up an attack of gonorrhœal ophthalmia, by which it is hoped the opaline vascular structure of the superficial layers of the cornea may become removed, leaving the cornea so far clear as to enable the patient to possess some

degree of vision. The fourth plan of treatment, as can be readily understood, is reserved for otherwise desperate circumstances. The general health ought in all cases to be attended to ; as the disease frequently occurs in lymphatic or strumous individuals. Repose of the eye ought to be enjoined, with due attention to diet, exercise, and change of air.

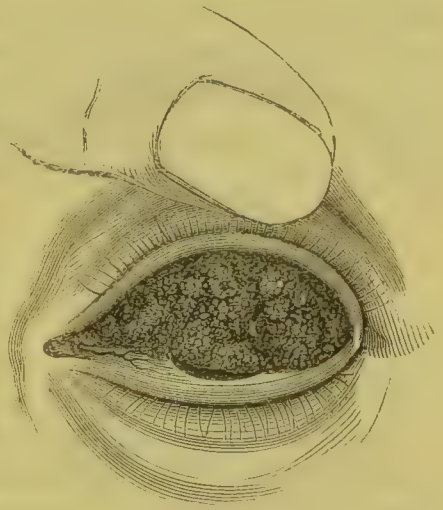


Fig. 248.

Pterygium.

Pterygium denotes a vascular and fleshy thickening of the ocular conjunctiva, invading the superficial layers of the cornea. The formation is of a triangular form ; the base resting on the internal or external canthus, and the apex stretching towards the cornea. When of moderate size, and not advanced further than the corneal margin, vision is not interfered with ; but when it encroaches on the cornea, the affection then ceases to be a mere deformity or inconvenience ; sight is in danger ; and remedial measures are required. Sometimes the web is thin and membranous ; consisting chiefly of varicose vessels held together by fine areolar tissue.

Fig. 248. Granular Conjunctiva. The eyelid everted.

Sometimes the structure is dense, firm, and fleshy ; sometimes it contains a large proportion of adipose substance.

The term *Pannus* is applied by some to the fleshy form of Pterygium, by others only to those cases in which the cornea is completely covered with red vessels, presenting the appearance of a piece of red cloth ; and, in either instance, the term is limited to a degree of change of structure which very materially interferes with vision.

In the slighter cases of Pterygium, constituting a mere deformity, no treatment is required, and stimulating applications only make it develop more quickly ; where, however, the cornea is encroached upon, division of the thickened conjunctiva, and the vessels ramifying in it, should be effected midway between the semilunar fold and the margin of the cornea. When the affection resists this, or when the web is thick and fleshy, excision of the portion extending towards the cornea, and involving its surface, is to be had recourse to. The membrane is elevated by a fine hook, or pinched up in the teeth of a pair of artery forceps, and carefully removed by knife or scissors. The portion next the semilunar fold should not be removed, lest, retraction of the caruncle occurring, an

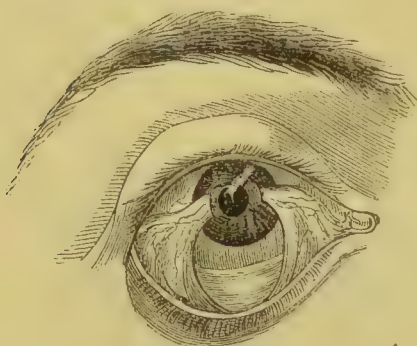


Fig. 249.

unseemly appearance of protrusion should be produced. When the whole cornea is covered, a cure is said to have been effected by the application of gonorrhoea matter to the conjunctiva ; the inflammatory process which thence results having the effect of breaking up the morbid tissue, and rendering it amenable to removal by absorption. This, however, is a hazardous mode of treatment as the eye may be destroyed in conse-

quence of the violent inflammatory attack which is induced. Such procedure, therefore, should only be resorted to in those extreme cases in which the cornea presents no sound part, but is completely and thickly covered ; and in which, consequently, the condition of the eye, so far as vision is concerned, cannot be made worse.

Affections of the Cornea.

Corneitis or Keratitis.

The inflammatory process, affecting the cornea, may be either an original affection, depending upon some alteration in the nutrition of its intimate structure, or merely an extension from previously existing conjunctivitis. We have already seen, that it constitutes the all-important condition in cases of scrofulous ophthalmia, and we shall have to allude to its occurrence as a consequence of several of the deeper seated affection of the eyeball. It may originate either from injury done directly to the part itself, or from an exciting cause applied to some other part of the surface of the eye. It may be either superficial or interstitial ; nebulous suppurative, or ulcerative ; or productive of sloughing. And when ther

Fig. 249. Pterygium, double.

is no mechanical irritation to account for its recession, the cause will generally be found in debility of constitution, scrofula, syphilis, or the exanthemata. Both eyes are seldom attacked at one time, but both frequently suffer in succession.

A zone of dilated sclerotic vessels encircles the corneal margin, generally at the upper part; but always corresponding to the site of the inflammatory attack; and between the two there is no intervening clear space of white sclerotic, as in affections of the deeper parts of the eye. Small hair-like vessels are seen ramifying, in greater or less number, continuous with those constituting the outer zone, giving it the appearance of a thin smear of blood. When the inflammatory change is interstitial, the haze of the corneal structure renders these vessels less obvious. Besides the sclerotic vascular crescent, a few of the larger venous trunks in the conjunctiva are turgid—those in the line of the recti muscles most commonly. The characteristic symptoms are, besides those anatomical changes just described—pain in the eye and in the orbit generally; lachrymation and intolerance of light; loss of transparency, brilliancy, and polish in the cornea—a more or less extensive haze occupying its structure, and giving it the appearance of stained, ground, or roughened glass. The various results of the inflammatory process may then ensue—

varying according to its intensity—viz., interstitial hyperplasy, producing thickening and opacity; formation of matter between the corneal layers—which puriform fluid may either become absorbed, or make its way either externally, leaving an excavated ulcer, or into the anterior chamber, producing hypopion; chronic ulceration, commencing superficially; or there may be a large ulcer, originating in a so-called pustule or phlyctenula; lastly, sloughing, either of the whole or of a part, may occur—seldom, however, in the case of simple

keratitis alone, but only when this is part of an extensive and severe ophthalmia. If a foreign body be left imbedded in the cornea, it is very evident that suppuration and ulceration must ensue; in obedience to the general law, whereby natural extrusion of foreign matter is effected in all living textures.

In the treatment, general depletion is injurious; for the disease is always due to some debilitating cause; and local abstraction of blood by leeches, although it may afford temporary relief, is of no real service. Counter-irritants, as by applying ethereal tincture of iodine, or blistering tissue, to the temples, are of the greatest importance; but if care is not exercised, the cervical glands are liable to become irritated. Painting the lids with the common tincture of iodine, making sure that none gets within the eye, is often of signal service. Steaming the eyes, the warm eye-douche, and the belladonna lotion, with hyoscyamus internally, will alleviate the painful symptoms. Stimulating ointments, and lotions, and nitrate of silver solution more especially, are very injurious. Our



Fig. 250.

principal dependence should be placed upon constitutional treatment. Good nourishing food and fresh air constitute the great essentials; while iron and quinine, with occasional doses of some suitable alterative cholagogue, will generally be found necessary in removing the debilitated condition of the system which maintains or protracts the disease. Cod-liver oil will also be found of great service, where suitable dietetic treatment cannot be obtained. The disease, it must be remembered, is always tedious; and restoration of the structural condition of the cornea will not usually become complete, for long after the inflammatory symptoms have been subdued; while a cornea which has once suffered from the attack is extremely liable to be again affected, from trifling and almost inappreciable causes.

Scrofulous or *Strumous* Keratitis has been already described under the name of Scrofulous Ophthalmia. A form of chronic corneitis, attended with interstitial inflammatory product, has very generally been attributed to the scrofulous diathesis; but Mr. Hutchison has satisfactorily shown that this form of the disease is in reality due to the existence of an hereditary syphilitic taint. To it therefore the name of syphilitic, or the chronic interstitial keratitis, may more appropriately be given. It occurs most commonly in children and adolescents, rarely commencing after the age of eighteen. Mr. Hutchison has observed it more commonly in females than in males, and in the eldest child of a family than in the younger members. It commences usually in one eye, by the appearance of one or more dots of a grey, brown, or hazy appearance, in the texture of the cornea; hence the name of "dotted keratitis" which has sometimes been applied. These separate opacities usually occupy the centre, or upper half of the cornea; they tend to coalesce, and thus produce a more or less dense central nebula; they rarely ulcerate. At the commencement, there is little in the vascularity of the sclerotic or conjunctiva to attract attention, and no great uneasiness or lachrymation to indicate evil. The dimness of vision which it produces is its most characteristic symptom; but as the disease progresses, the peripheral vessels become congested, and a fine vascular network permeates the textures of the cornea, ultimately pervading the whole of the opaque portion. The vessels are small and deeply seated, and the surface of the cornea remains smooth; thus differing from the vascular opacity which obtains in cases of granular lids. The physiognomy of the patient, the marks of old syphilitic affections, the presence of a small, ill-coloured, pegged, vertically-notched condition of the central incisor teeth, will serve to make good the diagnosis of this form of the affection, and point to its dependence upon syphilis as its cause; a conclusion which traces of a previous or coincident attack of iritis, with posterior synechia, will still further justify in some cases. The treatment should be essentially tonic, as in common keratitis; but added to this, mercurials and iodine, especially iodide of mercury and iodide of iron, will be found essential, if we hope to check the disease, restore texture, and prevent relapse.

Abscess of the Cornea.

Matter, as we have seen, may form between the layers of the cornea ; a result of corneitis. If it collect at the lower part, the accumulation usually assumes a crescentic form ; resembling the white semilunar mark at the root of the nail ; and hence such an appearance has been termed *Onyx*. But it may be produced elsewhere ; in the form of dots or points, which either may remain separate, or may unite with each other by increase and extension until the whole cornea becomes involved, and a yellow creamy opacity obscures the view of the iris. The fluid seems to be purulent. It may, however, be a less advanced inflammatory development of the corneal structures.

Antiphlogistics, if inadvisable in the acutely-progressive keratitis, are still more injurious now that it has terminated in suppuration. Iron tonics, good food, belladonna lotion, and atropine to dilate the pupils, should be employed, while counter-irritation should be repeated so as to keep up a decided effect. In many cases, absorption of the inflammatory product and partial restoration of the cornea will occur. Mercurials do no good. Opiates, especially hyoscyamus internally, with belladonna or chloroform liniment applied to the temple, will usually be required to soothe pain. Failing absorption, one of three events may occur. The small collection may spontaneously discharge itself internally, through the posterior elastic lamina, into the aqueous humour, forming an *hypopion* ; or it may escape externally, when an ulcer will be produced ; or first the one and then the other of these results may ensue. When such a perforation occurs, the aqueous humour of course escapes, the iris prolapses ; and when the aperture cicatrizes, the iris is retained in the cicatrix. An artificial opening may be made for its external evacuation ; but in the greater number of cases, the artificial opening is withheld, in the hope that disappearance by absorption may take place ; and the frequency with which this result does occur, has led to a suspicion that the fluid is not truly purulent. If, however, the fluid be of considerable quantity, causing tension in the part, and painful symptoms of an aggravated character, the abscess may be beneficially opened with the point of an extraction knife. The matter is discharged, and an ulcer remains, which heals readily. In some cases when the pain is excruciating, and uninfluenced by treatment, and the purulent collection marginal and extending, not only may the collection of matter be advantageously evacuated by puncture, but the aqueous humour may also be permitted to escape, the puncture being carried more deeply. Where perforation spontaneously occurs, the pain and acute symptoms subside ; and a like result generally follows this safe imitation of the natural process. When the abscess is central, however, such puncture should be avoided.

Ulcer of the Cornea.

Ulcers may be caused by paralysis of the fifth nerve, by inanition, or by exhausting disease elsewhere ; but are commonly the result of keratitis. Their origin may be from without, when the superficial layers of the cornea are chiefly affected ; and then the commencement is with super-

ficial abrasion, sometimes extensive ; or a phlyctenula forms, and superficial ulceration follows. In some cases the ulcer, commencing at one spot at the edge of the cornea, gradually extends in a crescentic form round the cornea ; the central portion, remaining attached only by the posterior elastic lamina, and having become opaque, either separates in the form of a slough, or, evacuation of the aqueous humour occurring at one or more points along the line of ulceration, it recovers its vitality, but remains more or less permanently opaque. The origin of the ulcer may be from within ; matter collects between the true corneal layers, and is discharged externally, leaving an ulcerated aperture ; or foreign matter has lodged in the cornea, and is extruded by suppuration and ulceration. In either of these latter cases, the ulcer is deeply seated, and more serious, because more likely to perforate, than when superficial and limited.

The ulcer here, as elsewhere, presents different characters, under different circumstances. Sometimes it is *acute* ; the inflammatory attack is still in progress, loss of substance is advancing, and there is no attempt at repair. In this state, the ulcer looks as if a portion of the corneal substance had been chipped out mechanically ; the edges are abrupt, or they may be thickened and swollen. Very frequently, a delicate plexus of vessels is found leading to the ulcer. The pain, lachrymation, and photophobia, are most distressing. Or the ulcer degenerates into the *irritable* form ; the loss of substance growing neither larger nor less ; the margins and surface shewing an angry and vascular appearance, often pulpy, as if covered with a layer of wetted chalk ; and the symptoms all undergoing intense aggravation. Or the sore may be of a *healthy and healing* disposition. Then the edges are less abrupt, and as if bevelled off ; the chasm is diminishing ; a white haziness surrounds the margins, and invests the surface ; and the painful symptoms are all very much diminished. In a patient whose vigour though temporarily depressed is unabated, or whose health and strength are maintained by appropriate treatment, this healing process is followed by a very slight depression, corresponding to the amount of corneal texture destroyed ; but in all cases where the ulcer has been both deep and wide, the cicatrix remains white and more or less deeply and permanently excavated. The ulcer, however, may stop short in the progress towards cicatrization, and assume the *indolent* character ; becoming stationary, and causing comparatively little inconvenience. This last phase, however, is certainly not the one of most frequent occurrence.

In the case of the acute ulcer, it is obvious that the only suitable treatment is to put the organ at rest, and to employ soothing measures such as we have already described in speaking of keratitis ; with at the same time the use of a diet suited to support the system, and to remove the debility which is always present in such cases. And this is to be continued until the inflammatory process is subdued, and symptoms of repair succeed those of destruction of texture. When the ulceration is very acute—spreading rapidly and deeply, attended with great pain, which is augmented at night, and occupies the frontal, temporal, and nasal regions—puncturing the corneal margin, either through the ulcer, or elsewhere, as may be most convenient, will put the parts at rest, and tend to restore a more healthy action to the ulcerating tissue. In many cases the appli-

cation of a pad of cotton wadding, by supporting the lids and keeping them at rest, saves the tender cornea from irritation. In the healing sore, we must content ourselves with watching the natural process of cure, and carefully guarding against reaccession of the inflammatory attack; by exclusion of light and other stimuli, by regulation of diet, and by the continued use of soothing applications. In the irritable and deeply-excavated sore, nothing is so useful as the nitrate of silver; applied lightly and carefully to the ulcer, in powder, by means of a moist hair pencil. The application is repeated every second or third day, until the irritability ceases; or the interval is shortened or increased, as circumstances may seem to require. When either the irritable or inflamed condition threatens to prove obstinate, great benefit often is derived from counter-irritation by blistering the temple or behind the ear. For the indolent sore, the various stimulant collyria are suitable, and constitutional treatment indispensable.

As a general rule, the preparations of lead should never be employed as collyria, in the case of ulcer of the cornea. An insoluble chloride of lead will be formed; and this, becoming entangled in the cicatrix, will render it more irremediably opaque than it otherwise would have been. The sustained use of nitrate of silver, also, should be conducted with caution; lest an olive-coloured stain ensue.

When the ulcer is deep, acute, and situate near the centre of the cornea, there is great risk of perforation of the inner layer, escape of the aqueous humour, and protrusion of the free margin of the iris, to a greater or less extent. To obviate this last accident, as much as possible, belladonna or atropine solution is employed to maintain a dilated state of the pupil; so that the margin of the iris may be retracted, out of harm's way, ere the perforation occurs. If, however, the site of ulcer be towards the circumference, the use of belladonna would probably be prejudicial. In all such cases, by puncturing the cornea, at its outer margin, the perforation of the sore may be prevented; or should it occur, the absence of the sudden gush of aqueous humour will avoid the implication of the iris in the opening.

Previously to completion of the ulcerated aperture, the posterior elastic layer of the cornea sometimes protrudes, in the form of a small transparent vesicle; this condition is termed *Hernia of the Cornea*. It is recognised by its transparency, and the absence of collapse of the cornea. It should be treated on the same principles as the ulcer about to perforate; and if the patient will not permit paracentesis to be employed, the pad of cotton wadding retained by a strip of plaster, or aallet, should be used to support the cornea and protect it from friction.

Sometimes the perforating ulcer heals only in part; contracts, but does not close; becoming a fistulous aperture, through which the aqueous humour continues to escape. This is remedied by the occasional application of nitrate of silver, in powder, by means of a moistened and pointed hair pencil; and by a tonic system of treatment constitutionally.

The iris, protruding through the perforated cornea, forms a black humour, usually of no great size; bearing a slight resemblance to the head of a fly; and therefore termed *Myocephalon*. Sometimes the iris does not protrude, but simply rests upon the aperture, and closes it up;

and in this abnormal position it may become adherent. In either case the pupil will be deformed; and vision may be seriously impaired—may be completely intercepted, by the whole margin of the pupil being implicated in the prolapse of the iris. The indications of cure are, to restore the iris to its normal position, and to hasten cicatrization of the



Fig. 251.

aperture. In recent cases, we may attempt to obtain recession of the protrusion; not by mechanical efforts to push it in at the opening, but by placing the patient on his back, and applying atropine, while support is afforded by means of the pad of cotton. When the protrusion remains, the displaced portion of the iris contracts permanent adhesions with the cornea. Sometimes, however cicatrization goes on but slowly, the iris retain

its normal colour and fibrous aspect, and admits of a constant draining away of the aqueous humour; then cicatrization of the sore will be much expedited by touching the black elevation, from time to time, with nitrate of silver, till an opaque white cicatrix, and a normal anterior chamber, indicate that the ulcer is completely healed.

Opacities of the Cornea.

These may be interstitial or superficial—due to changes in structure produced by inflammatory product, abscess, or ulceration of the cornea. According to their intensity they have received the names of *Nebula*, *Albugo*, and *Leucoma*. By some, however, these terms have been employed to indicate the degree of the process producing, or the depth of tissue implicated in, the disease;—*Nebula* occurring when the inflammatory change has affected only the superficial structure; *Albugo* and *Leucoma* resulting from the cicatrization of ulcers, which penetrate more or less deeply through its textures. The superficial form of opacity is gradually shaded off into the surrounding healthy corneal tissue, and is easily distinguished from a deep cicatrix, which has a sharp outline and well-defined margin. In some of the deeper cicatrices a black spot exists in the otherwise white opacity;—in such cases the ulcer has perforated, *prolapsus iridis* has occurred, and that part of the iris which protruded is now implicated in the cicatrix. In practice, it is of great importance to distinguish these permanent opacities, which are due to deterioration of tissue, from the hazy conditions which give to the cornea the appearance of steamed glass, and are characteristic of progressive keratitis. In the former, all remedies, except in very young children are useless; in the latter, appropriate treatment may check the disease and admit of the cornea regaining its normal transparency. The recent occurrence of the symptoms, the presence of the vascular zone of the sclerotic, and more or less pain or irritability, characteristic of the latter should serve to indicate that the inflammatory process is still in progress and lead the practitioner to delay his prognosis as to how much of the opacity will be permanent, and how much is amenable to treatment, until he has subdued the inflammatory process which has produced these

Fig. 251. Myocephalon.

changes. Cases, too, of vascular nebula, like ground glass on the surface, occupying the upper half of the cornea, should always direct the attention of the surgeon to the state of the conjunctiva of the upper lid ; as there the source of the change will probably be found in a granular condition, the appropriate treatment of which will in most instances admit of the cornea regaining in a very great measure its healthy state. Those cases, also, in which the changes in the cornea are a mere result of deeper seated mischief, as in glaucoma, must be recognised ; else the time when treatment of the disease could be employed with satisfactory results may be allowed to pass, and complete blindness be the result. In examining recruits, or soldiers for discharge as unfit for service, it should be remembered that there are forms of nebula, where the degree of opacity is slight, but where its general diffusion throughout the whole cornea renders vision quite indistinct, from the amount of irregular refraction which it produces.

In treating opacities of the cornea, it is well to recollect that after the age of puberty any interference with an opacity which is unattended with inflammatory symptoms is quite unnecessary. Washes, drops, powders, are unavailing ; and all that can be done is to prevent matters becoming worse, by warding off inflammatory attacks, or checking these when they occur. Even in adult life, the degree of opacity will always diminish to some extent spontaneously, leaving only the denser alterations of tissues as a permanent spot. And in early life, time and tonic treatment will do wonders in restoring an eye to some degree of usefulness, in which the cornea has apparently undergone a well nigh hopeless amount of deterioration from recent ulceration. If one eye is blind, while in the other the opacity is central and small, vision will be greatly improved by habitual dilatation of the pupil by means of atropine ; if the opacity be both central and large, the only hope of amendment is by the formation of an artificial pupil. If the other eye, however, is sound, such interference will only create a distressing confusion. Where vascular nebulae of both corneae deprive the patient of all sight, and when other and milder plans of treatment have failed, it has been proposed to set up acute gonorrhoeal ophthalmia, as in the case of pterygium, or annulus, in the hope that as the inflammatory process subsides, the cornea may be restored in some measure to a useful condition. This desperate and apparently doubtful remedy has, on trial in several cases, been followed by such results as fully to justify its employment ; enabling patients who had been virtually blind, to go about unassisted, to recognise their friends, and even to read. It has been proposed to dissect off opacities of the cornea ; but obviously success can never follow any such procedure ; inasmuch as the loss of substance, caused by the dissection, must heal in the ordinary way, and, so healing, must produce at least an equally opaque and extensive cicatrix. It is quite reasonable, however, to operate in one class of cases ; with a fair prospect of ultimate benefit. The opacity which follows injury of the cornea by sulphuric acid would seem, occasionally at least, to be a chemical incrustation on the cornea, rather than a vital change of and in its structure ; sulphuric acid is said to be produced, and adheres to the external layer of the cornea ; and this may be scraped away, immediately after receipt of

the injury, by the edge of a knife, leaving the rest of the part clear and free.* When the opacity consists of a deposit of lead, as a chalk-like layer in the site of an ulcer, this may easily enough be removed with satisfactory results by means of a minute steel spatula, or gouge; and the same plan of treatment has been successfully employed by Messrs. Bowman and Dixon in those very rare cases, where calcareous deposits occur between the cornea proper and its epithelial coating.

In advanced years, and sometimes even in the comparatively young adult, the corneal periphery gradually becomes opaque, and of a grey colour. The change has been shewn by Mr. Canton to depend on fatty degeneration of the tissue; with a surmise that it may sometimes prove to be an important external indication of similar lesion in more vital parts.† The affection is termed *Arcus senilis*; in itself a mere deformity; and not amenable to remedial treatment.

Staphyloma of the Cornea.

Staphyloma is an opaque projection occupying the position of a part, or of the whole of the cornea.

Partial staphyloma is usually situated at the lower or lateral part of the cornea. The iris is adherent to the whole inner surface of the projection, and consequently the anterior chamber is much diminished in size; generally the pupil itself is more or less involved, and vision rendered very imperfect. The affection is caused by an ulcer penetrating the cornea, and allowing the iris to become prolapsed through the opening. When a considerable portion of the iris has protruded, it does not shrink when the inflammatory process subsides, but remains, and forms a projection at that part of the cornea. After a time the exposed projection of the iris is covered by an opaque firm tissue, of the nature of cicatrix the edges of which become incorporated at the base with the sound cornea. It is generally the consequence of strumous, catarrhal, or purulent ophthalmia.

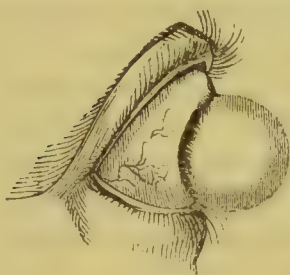


Fig. 252.

Total staphyloma is formed exactly in the same way; it differs only in degree. When, as is often the case in purulent ophthalmia, the whole or greater part of the cornea is destroyed, the iris falls forwards, the pupil closes, and the aqueous humour, accumulating in the posterior chamber, keeps the iris distended in the form of a tumour in the front of the eye. The surface of this tumour, as in the partial staphyloma, becomes gradually covered with a firm opaque cicatrix-like tissue, of more or less thickness; and a total staphyloma results. This pseudo-cornea, or staphyloma, has the form and appearance of a small globe stuck on the front of the eye, with sometimes a ring of the proper cornea surrounding its base. It is often so large as to project considerably from between the eyelids, and prevent them from closing.

* Lancet, No. 1010, p. 537.

† Lancet, Jan. 11, 1851.

When the staphyloma is large, the iris, being unable to expand to the same extent as the pseudo-cornea, is torn and separated from the choroid; and when the staphyloma has been removed, the iris is found in contact with its posterior surface, broken up and in shreds. This does not occur in a small or partial staphyloma. Vision in total staphyloma is completely destroyed.

For the treatment of a small partial staphyloma, the less that is done the better; except to guard against any tendency to inflammatory accession. If it be large and implicate the pupil, the projection may be diminished, by touching it from time to time with some caustic—as the caustic potass—in order to produce condensation and contraction; which the caustic does by producing a slough; this separates, leaving an ulcer, which cicatrizes by contraction. When the patient is blind of the other eye, and the displacement of the pupil, or its complete implication, renders the patient blind altogether; then either the iris may be cut through, close to its point of cohesion to the cicatrix within the partial staphyloma, so as to allow the membrane to retract; or an artificial pupil may be made, at a point corresponding to a clear part of the cornea.

In the total staphyloma, relief is sometimes obtained by puncturing it from time to time with a large cataract needle, and allowing the aqueous humour to escape; when the projection collapses. As the aqueous humour, however, becomes almost invariably reproduced in the same or even greater quantity; and as the staphyloma is a great deformity, besides keeping up a constant state of irritation which is apt to extend to the other eye, its removal should be recommended, so that the globe may be allowed to collapse permanently, the cut surface to heal, and an artificial eye to be worn. In removing a staphyloma, the eyelids being kept open by means of a spring speculum, the base of the tumour is transfixed with a cataract knife, from its temporal to the nasal side, a little below its transverse diameter; the knife is then pushed on, and a flap, of the upper half of the projection, is formed as it cuts itself out. This flap is seized with a pair of forceps, and that part of the base of the staphyloma which remains uncut is divided with curved scissors, and the whole removed. The lens and some of the vitreous humour often escape; but the stump which remains suits admirably for an artificial eye. After the operation, a pledget of lint soaked in cold water, a pad of cotton wadding, or a wet sponge, should be kept applied upon the eyelids, and retained by means of a bandage; to prevent bleeding into the cup-shaped cavity, and to keep the parts thoroughly at rest. If severe reaction supervene, it is to be treated by active antiphlogistics. Should the staphylomatous eye have occasioned sympathetic irritation in the sound eyeball, excision of the globe should be practised as a more certain method of securing relief.*

* *Vide* Wharton Jones' Manual, p. 186, *et seq.*, and London Med. Gazette, vol. i. p. 847; Bowman, Lectures on the parts concerned in the operations on the eye, 41.

Conical Cornea.

Sometimes the cornea, retaining its transparency, gradually assumes a conical or pyramidal form; and when viewed in front, reflects and refracts the light so as to exhibit a peculiarly brilliant and sparkling appearance like a large dew drop, which is quite characteristic of the disease. The very apex of the cone, rounded off and usually faintly nebulous, is situated in most cases in the centre of the cornea; in some instances it has been observed to occupy a lateral position. The apex is the thinnest part of the projection, and if attacked by ulceration, then staphyloma may supervene. Although perhaps accompanied by keratitis, it is certainly not due to it; and whether increased intraocular pressure, or an atrophic thinning of the corneal structure, is the first stage of the disease is still an unsettled point. It generally affects both eyes, though not in an equal degree; has been observed at all periods of life, but more commonly between puberty and thirty years of age; and is said to be most prevalent among females. On the whole, it is a rare affection; and fortunately it is so, being but little capable of amendment.

In slighter cases of conical cornea, palliation may be obtained by adapting deeply concave glasses to the eyes, or by employing a black plate pierced with a single rounded aperture the size of the pupil, or with a narrow horizontal slit; the pupil being kept dilated. It has been said, that amendment, if not cure, has followed perseverance in the use of purgatives and emetics;* but how the beneficial result is obtained, it is not easy to understand or say; all the more as further



Fig. 253.

experience has not confirmed the eligibility of this otherwise injurious plan of treatment. Late iridectomy, division of the ciliary ligament, and intraocular myotomy have been said to produce satisfactory effects, especially when other signs of intraocular pressure were present. Sir W. Adams suggested extraction of the crystalline lens. Mr. Tyrrell advised displacement

of the pupil, which is a reasonable enough procedure when the apex is opaque. But as a rule, in uncomplicated cases of conical cornea, operation is quite unnecessary.

Over-distension of the Cornea.

Simple over-distension of the cornea, by an unwonted accumulation of the aqueous humour, is a frequent concomitant of keratitis, and readily yields to appropriate treatment; always being relieved by paracentesis of the cornea. This little operation is best performed by means of either a common extraction knife, or a double-edged lance-bladed artificial pupil.

* Pickford, Dublin Journal of Medical Science, January 1844, p. 357.

knife. The point of the blade is introduced as for extraction, through the true corneal structures, entering the aqueous chamber parallel to the iris, when, turning the blade slightly on its axis, a gush of aqueous humour occurs, and the tense and prominent cornea flattens. The prolapse of the iris, with due care, should not come in contact with the knife, or become entangled in the puncture as the blade is withdrawn. Sometimes severe neuralgic pain immediately follows the evacuation of the aqueous fluid; but this soon passes off, leaving the patient relieved from all the pain and uneasiness produced by the disease. In many cases, the large and tense anterior chamber is symptomatic of the commencing stages of a diffuse intraocular inflammatory affection called glaucoma, for which various operative procedures have been recommended within the last few years.

Affections of the Sclerotic Coat.

Sclerotitis.

This, in the *Acute* form, may occur as part of a general inflammatory process, however excited. We have already described it as symptomatic of keratitis; we shall find it occurring in every case of iritis. Not unfrequently, it exists *per se*, and then it has very generally been called rheumatic ophthalmia; and that not because it was either a metastatic result of a rheumatic attack, or only occurred in persons of a rheumatic diathesis, but because exposure to cold has usually proved the exciting cause. It is most frequent in the adult, and about the middle period of life, and is often limited to one eye. Vision is always impaired. Pain is complained of, of a dull, aching kind; increased by pressure, and by movement of the globe; partly referred to the eye, but mainly to the forehead and temple, along the course of the fifth nerve; and marked exacerbation occurs at night. At the commencement of the disease, the eye feels hot and dry, and this condition may continue to the termination of the attack; but in some cases, the subsidence of the acute symptoms is accompanied by an increased secretion of tears; and when complicated by the existence of catarrhal ophthalmia, the copious lachrymation is a constant accompaniment of the sympathetic pain and other characters of the sclerotic inflammatory process. There is, generally, however, in pure cases of sclerotitis, little lachrymation or intolerance of light. The sclerotic vessels are seen enlarged, radiating in straight lines outwards, and forming a vascular zone of a pink hue, around the circumference of the cornea (Fig. 246, p. 672). In some cases, a narrow white line often encircles the cornea, leaving a space between it and the pink zone. In other instances, the pink zone advances to the very corneal margin, and sometimes even invades its texture. The tint, too, is not always of the carmine pink colour, but has frequently a violet hue; yet it cannot be mistaken for the network, of a vermilion tint, which is so eminently characteristic of conjunctival affection. There is always a considerable degree of general febrile excitement, accompanied with gastro-hepatic derangement, indicated by thirst, a foul tongue, and complete anorexia. Not unfrequently, the pupil is contracted, and incapable of its wonted

activity of motion ; this denotes that the iris has participated in the morbid state. The conjunctiva, too, frequently sympathizes more or less ; and by its large, florid, tortuous vessels, the sclerotic characters may be in part obscured.

In the *Chronic* form, the affection is certainly most common in persons subject to gout and rheumatism. In such cases, the symptoms come on insidiously, the whole sclerotic seldom suffering at once ; but, commencing in one part, the inflammatory process remains there for a time, subsiding to reappear elsewhere, or in the other eye. That portion of the iris corresponding to the sclerotic congestion is generally sluggish, or quite uninfluenced by atropine, while the rest dilates readily. In some cases the iris is manifestly implicated in the inflammatory mischief, as a change in tint of the iris, adhesions to the capsule of the lens, and a delicate filmy pupillary formation of lymph will serve to indicate. Mr. Wilde has attributed these obstinate, partial, and erratic sclerotic inflammatory conditions to an affection of the ciliary body.

In the treatment of the *Acute* form, blood-letting used to be resorted to ; cupping the temple and free leeching being recommended. A smart purgative, followed by the employment of opiates, especially at bed time, will be found productive of greater and more permanent relief. In some cases calomel, given in two grain doses with half a grain or a grain of opium, will be found quite necessary ; but colchicum, with quinine and salines, is more generally productive of relief. At the same time too rigid an antiphlogistic diet must not be employed. To relieve the severe frontal and temporal neuralgia, belladonna ointment, chloroform and oil, tincture of aconite liniment, and veratrine ointment will, in the order given, be found to afford satisfactory results. Blisters do no good in the acute stage. Hot fomentations increase the pain, but dry heat sometimes relieves it. Atropine solution dropped into the eye should be employed once or twice a day. In the *Chronic* form, a careful and unstimulating but nutritious diet should be given. Quinine or cinchona and soda, colchicum, iodide of potassium, guaiacum, will be found very serviceable in different examples of this form of the disease ; and when the iris is affected, and vision much impaired, mercurials should at once be given ; to be stopped, however, so soon as the breath is affected, and quinine and chlorate of potash substituted. Blistering over the forehead and temple is a very useful agent ; and atropine solution, employed from the first, will prevent mischief being done by the formation of adhesions if the iris becomes implicated.

Staphyloma of the Sclerotic.

This is much less frequent than staphyloma of the cornea. Generally it is the result of inflammatory affection of the choroid, and change of structure so induced. The sclerotic becomes attenuated and yielding in the intervals between the recti ; the engorged choroid coat shines through it ; and if the disease progresses, irregular bulgings form, constituting several swellings of a bluish or leaden hue. The external vessels are usually enlarged and tortuous. The prominence may become so great as to demand surgical interference. When protrusion takes place from

between the lids, then diminution by either puncture or incision may be tried, in the hope that by allowing the fluid within to drain off, atrophy of the globe may occur; but if this be not effectual, iridectomy, division of the ciliary ligament, or intra-ocular myotomy, may be employed; or the aqueous humour ought to be discharged from time to time through an incision in the cornea; or the cornea, with the iris and lens, may be altogether removed, and then the globe will collapse, and the eye shrink



Fig. 254.



Fig. 255.

to a small size. But in most of the cases in which operative interference is required, the eye is totally destroyed in point of function, and its altered and diseased textures act as a constant source of irritation to the sound eye. In such circumstances, excision of the globe is a preferable operation to those just mentioned. In the early stage, internal use of the arsenical solution seems to exert a beneficial influence in preventing or checking the bulgings of the sclerotic.

Affections of the Iris.

Iritis.

Inflammatory affection of the iris may be the result of injury, accidental or operative, or it may be of idiopathic origin; it may occur primarily, itself constituting a disease, or it may be but a part of general deep ophthalmia; it is often connected with the syphilitic taint of system; and not unfrequently it is of a rheumatic character. The accidents which are most prone to excite the inflammatory process, are the lodgment of foreign bodies in contact with the iris, the tearing away of some portion of its border from its ciliary attachment, or displacement of the lens pressing the iris forward against the cornea. Mere wounds of its texture, as in the operation for artificial pupil, or when its surface or edge falls before the knife in extraction of a cataract, are not usually attended by any inflammatory symptoms; and now-a-days, even when a considerable portion of its whole breadth is removed in the operation of iridectomy, no inflammatory mischief is found to result. Various unintelligible and minute divisions of iritis have been resorted to by continental authorities, but without any real practical advantage. There are certain

Fig. 254. Staphyloma of the Sclerotic Coat; seen in profile.

Fig. 255. The same disease; seen in front. *Staphyloma racemosum*.

symptoms common to all cases of iritis ; certain modifications which are observed in different forms of the disease. The *traumatic*, the *rheumatic* and *gouty*, the *syphilitic*, and the so-called *scrofulous*—presenting the modifications of more or less symptomatic intensity, and thus requiring the further designation of *acute* and *chronic* to characterize them—are all that need require remark. The general characteristics of inflammatory affections of the iris, whatever their cause, or whatever the state of constitution, are—1. The presence of a well-marked sclerotic vascular zone, with a marginal interspace void of vascular engorgement around the cornea. 2. Change of colour of the iris, and muddiness of the aqueous humour. 3. Diminished mobility of the iris, with more or less change in the pupillary outline. 4. Loss of fibrous marking of its texture, with more or less increased vascularity, thickening, and inflammatory product. 5. Intolerance of light, and increased lachrymal secretion. 6. Pain in the globe, orbit, and circum-orbital region. 7. Impairment of vision. Were the inflammatory affection of the iris to implicate no other texture than its own, the disease would be of comparatively trifling moment ; the risk, however, in all cases is great that the pupil becomes more or less involved. It may be occupied completely with lymph, constituting closure of the pupil, or complete *atresia iridis*. Its margin may become adherent to the capsule of the lens, constituting *synechia posterior* ; or when, from thickening and product, it has come in contact with the interior of the cornea, *synechia anterior* may then form. But this is not all. Where recovery has taken place, and we examine the interior of such an eye by means of the ophthalmoscope, permanent changes in the retina and choroid indicate that they too have suffered ; and that what we see occupying the visible iris must be regarded, only too frequently, as an indication of similar



Fig. 256.

but more seriously important changes going on in the deeper-seated structures of the eyeball. These changes in the fundus of the eye serve to explain the variable degrees of diminution of vision which are observed in cases of iritis, frequently altogether disproportioned to any change of structure to be seen in the iris or pupil. When the inflammatory affection of the iris is *acute*, there is always considerable

constitutional sympathetic derangement ; when *chronic*, the disease is always very insidious, and may advance to complete destruction of the function of the globe, with but little local uneasiness and no constitutional irritation.

Traumatic Iritis.—We have already said that mere wounds of the iris are little if at all resented when its textures are healthy. Even separation of it from its ciliary attachment by blows may be followed by very slight indications of mischief. In such instances the irritation which follows, if not aggravated by carelessness, exposure, over-feeding, or the use of stimulants, seems almost a healthy process. It is very different,

Fig. 256. Iritis ; shewing the characteristic vascularity of the globe, the iris clogged with lymph, the pupil contracted and irregular.

however, when a foreign body either is lodged in the iris, or lies in contact with it in the anterior or posterior chamber ; or when a partially or completely dislocated lens compresses its textures against the cornea, or even rests against it, having fairly escaped into the anterior chamber ; and if a wound exists in the cornea at the same time, through which the aqueous humour drains away, the evil is only exaggerated. Not only does the iris inflame, the pupil become occluded, the cornea hazy, the anterior chamber filled with pus, but the deeper structures are disorganized, and the rapid chemosis of the conjunctiva indicates the grave nature of the disease. All this, however, should have been anticipated and prevented by the removal of the foreign body, if it is visible, or the extraction of the lens as speedily as possible, if it has been dislocated. If an opening exists, and is marginal, it should be extended by scissors—or by the secondary blunt-pointed cataract knife, if more room is needed—and then the foreign body, secured by canula forceps, is extracted ; or it may be fixed by means of a small spatula if it has subsided in the aqueous humour, and an incision made at a corresponding point to effect its removal. In making any new incision, care should be taken to avoid isolating unnecessarily any portion of the cornea between the wound and our section. In the case of the dislocated lens, if entire, its extraction will be facilitated by means of Graafe's spoon scoop. If much broken up, a linear incision and the introduction of a spoon scoop of smaller size, will afford ample space for the removal of the fragments. In all such cases, blood-letting, mercury, or other antiphlogistics, are worse than useless while a foreign body is present. After its removal, however, mercurials will prove of use in getting rid of any inflammatory products which may remain.

Rheumatic and Gouty Iritis.—This may be either *acute* or *chronic*, and has always more or less of the characters of scleritis mixed up with it. It is usually, when *acute*, due to imprudent exposure to cold and damp. The vascular zone merges in general sclerotic congestion, and has frequently a violet or purplish tint. The cornea is often more or less complicated at the same time. The changes in the iris are slightly marked, and may easily be overlooked, till adhesion has occurred to the capsule of the lens. The vessels of the iris may, however, be recognised, running in a radiating direction from the centre to the circumference. At an early period, in most acute cases, the intolerance of light and copious lachrymation are well marked, and the circum-orbital neuralgic pain is very characteristic. In the *chronic* form, the risk of serious results is greater than in the acute, from the almost total absence of any decided symptom, except impairment of vision, to attract attention to the real nature of the disease till disastrous changes have occurred.

Syphilitic and Scrofulous Iritis may be taken together, as structurally they very closely resemble each other ; nay, in many cases, the so-called scrofulous taint has had very just reason, from the aspect of the child and the existence of pegged teeth, to be suspected as derived from a syphilitic source, and to require the employment of remedies suited to the stage of advanced secondary or tertiary syphilis. In *Syphilitic iritis*, recognised to be such by the coexistence of some form of undoubted syphilitic eruption on the skin, with an indolent multiple chain of

enlarged lymphatics leading from the site of the indurated chancre to the trunk, three forms of the disease in the iris have been recognised. The *first* or serous, implicating the surface of the iris only, and accompanying the exanthematous syphilitic eruptions, is attended with considerable muddiness of the aqueous humour, which becomes of a pale yellow tint from admixture with the colouring matter of the blood, and tones the hue of the discoloured iris of a more or less buff or rusty tint, but admits of the fibrous structure of the iris being recognised through it. The cornea is usually, especially in its lower half, dotted over with minute pin-point marking, of a saffron hue. In the *second* form of syphilitic iritis, usually accompanied by the scaly eruption upon the surface, the texture of the iris seems as if infiltrated and thickened, and its colour in the part affected is of a coppery hue; the thickening often affecting principally that part close to the pupil, and forming a ring of discoloured texture. The fibrinous product of the inflammatory process is sometimes produced in considerable quantity; commencing as a fine filmy layer, but gradually increasing by fresh additions to its mass. The *third* form of syphilitic iritis is usually met with during the late secondary and early tertiary symptoms, and is associated with the pustulo-crustaceous eruptions. Here fibrinous nodules of a brownish-ruddy hue varying in number and size, stud the surface of the iris, or occupy the pupillary margin, sometimes forming close to the point of junction of the iris, cornea, and sclerotic. As they enlarge they soften, the centre becomes more and more yellow in tint, sometimes very closely resembling a pustule in appearance, and, giving way, a yellow creamy fluid gravitates to the bottom of the aqueous humour, thus producing *Hypopyon*; or, should the pustule be situated at the junction of the cornea and sclerotic and iris, the pus may escape externally. In some cases the pus is mixed with blood; or blood may be extravasated from the engorged vessels of the iris, at an early period of any of these unhealthy forms of iritis—constituting inflammatory *Hypœœma*.

In all cases of syphilitic iritis the vascular zone in the sclerotic is well marked, no general sclerotic congestion having occurred. The intolerance of light is slightly developed, and sometimes quite absent; the impairment of vision is always decided. The pain has generally marked exacerbations, usually occurring at night. There is nothing so characteristic in the form of the pupil, as to make it distinctive as a means of diagnosis. Our prognosis in such cases depends entirely upon the degree of structural change produced by the inflammatory process. The second and third forms, occurring in cachectic patients, are always followed by more or less permanent deterioration of vision. Syphilitic iritis* occurs sometimes in children and infants, as a part of the manifestation of the constitutional disease transmitted to them. It is however rare, as a symptom of syphilis in children, compared with its frequency in adults. Indeed, the local symptoms are seldom well marked, and hence its infrequency is apparently greater than it really is; for the sclerotic congestion is never characteristic, and the distinctions just described as occurring in adults cannot be made out in the case of infants. When the disease does occur in them, however, the quantity

* Hutchison, Ophthalmic Hospital Reports, 1st vol. 1858.

of fibrinous product is usually very considerable. In *scrofulous iritis*, copious purulent tubercular formations—terminating in *Hypopion*, and often combined with *Hypoœma*—great obstinacy, a tendency to recur, and permanent changes in the deeper seated textures of the eye, accompanied with thinning of the sclerotic, and a disposition to enlargement of the veins of the iris and choroid—may be said to characterize the disease.

In *Gonorrhœal Rheumatism*, if the eye is affected, the aqueous humour becomes turbid, flocculent, and sometimes even occupied by a tufted white lymph, so that the pupil and iris are for the time concealed. In such cases, however, our prognosis may be satisfactory, as under appropriate treatment the lymph becomes absorbed and the eye restored to its healthy function.

Treatment of Iritis.—In all cases, a broad prominent shade should be worn over both eyes, and if it admits of free ventilation so much the better. It must in no case consist of a patch closely covering in the affected organ. If there is much pain, and much intolerance of light, a few leeches may be advantageously applied to the temple, over the nasal process of the maxillary bone, close to the inner canthus ; but general blood-letting, cupping, or arteriotomy, is quite unnecessary. Iridectomy, or division of the ciliary ligament, where tension of the globe and symptoms of choroido-iritis exist, will be found a powerful adjuvant to other treatment. If the pain occupies principally the temporal and supra-orbital regions, and is of a neuralgic character, the application of chloroform and oil, aconite, or atropine, diluted with soap liniment, to those parts, will give more permanent relief than leeching, especially in anæmic patients ; and where there is much feverish excitement, a brisk purgative will prove very beneficial. Fomentation of the eye by means of belladonna in solution, applied with a piece of sponge, often affords relief ; or the continuous eye-douche syringe may be employed for this purpose, the solution being kept warm in a tin vessel surrounded by boiling water. It is a question with some surgeons whether Mydriatics, or remedies to dilate the pupil, should be used in the early stage of iritis. The object with which they are employed is to attempt to dilate the pupil, and thus prevent adhesions forming between its free margin and the capsule of the lens. Now, no doubt, so long as the iris is inflamed it will not dilate, and were the iris in all cases equally affected, then there would be no advantage in employing means to dilate it so long as it was in a condition incapable of responding to them. But this is not the case ; the iris is seldom equally affected, especially in cases seen at an early period of the attack ; and therefore the solution of atropine should be used from the commencement, and employed throughout ; all the more so, that, when a non-acidulated and aqueous solution, it serves to soothe pain, and to indicate, by the pupil beginning to dilate at that part which has been inflamed, that the inflammatory process is subsiding. When the iris is adhering, there is all the more urgent need for its employment, with the hope that the adhesions, still soft and tending to become absorbed both naturally and from treatment, will yield to the dilatation of the iris, and thus permit this membrane to acquire its natural mobility. The use of mercury in iritis is at present a debated question. Some

holding that its employment is unattended with any advantage over that of turpentine, quinine, or morphia; while others maintain that it is positively injurious. There may be cases in scrofulous or even rheumatic patients, where mercury is badly borne, or where its employment is ill timed or pushed too far; but in syphilitic iritis there is certainly no remedy which possesses such manifest power in checking the advance of the inflammatory process, and in removing its results. Calomel, in two-grain doses, every two, three, or four hours, is preferred where the effect of the remedy is desired as promptly as possible; and to prevent its passing off by the bowels, opium or morphia should be combined with it. In ordinary circumstances the blue pill, in two or four grain doses, is preferable; and in the more advanced forms of syphilitic iritis, the proto-iodide of mercury in half grain doses, night and morning, will often be found more satisfactory than either of the other preparations. Should there be much constitutional debility, quinine, iron, chlorate of potash, a nutritious diet, and even stimulants may be given in addition to the mercurial with great advantage. In cases of rheumatic and gouty iritis, though mercury acts very satisfactorily in assisting the removal of any product, iodide of potassium, colchicum, and guaiac, with quinine and iron, will usually be required in combating the condition of system which is present. Sometimes too, turpentine,* either in emulsion or in the form of Chian turpentine, will prove of service; and great venous congestion of the iris, and *Hypœœma*, with a tendency to relapse, have been supposed specially to indicate their employment. If given, their administration should be carried the length of purgation and the production of strangury, else no good attends their use. In scrofulous iritis—besides the cautious administration of mercury, tonics and cod-liver oil are indicated. When the ill-formed (pegged) condition of the teeth is present, grey-powder and iodide of potassium will be found very serviceable.

In the more chronic forms of the disease, counter-irritation may take the place of the direct antiphlogistics. And, ultimately, when traces of the affection still linger, the internal administration of tonics, especially of quinine, proves beneficial by dissipating the state of passive congestion which threatens to remain.

When *Hypopion* has formed rapidly, and when the purulent accumulation is considerable, it has been proposed to make an opening at the lower part of the cornea, by means of a cataract knife, so as to effect evacuation. To this there can be no objection. It is dangerous, however, when the accumulation is small, and there is no tension of the globe; then it is better to trust to the administration of mercury, than to encounter the risk of aggravating the inflammatory mischief by operative interference.

The extravasated blood of *Hypœœma* requires no treatment as such; and when the inflammatory symptoms subside, the extravasation may

* Mr. Carmichael's Formula is as follows:—Recipe—Ol. Terebinth. rect. unam—Vitel. unius ovi—Tere simul, et adde gradatim, Emuls. Amygd. unc. quatuor—Syrup. cort. aurantii unc. duos—Spir. Lavend. comp. drachmam, c. semisse—Olei Cinnamomi, guttas quatuor. M. ——— Dosis—unc. un. ter in die. Glycerine with port wine, or Tr. Cardamom co. and water, are preferred by others as solvents and corrigents of the turpentine.

be expected to disappear gradually by absorption. The occurrence of Hypoæma, however, as indicating a depraved state of system, is always of bad omen.

The adhesions, or *Synechiae*, are superable in the recent state. By perseverance in the local use of atropine, the imperfectly organized fibrin is extended or torn, and the iris recovers its normal play. At the same time, absorption of the product is to be favoured, by moderate continuance of the mercurial.

Changes in the Pupil and Iris.

Unusual dilatation of the pupil is termed *Mydriasis*, and is produced artificially by atropine, belladonna, or its congeners. It may also be of idiopathic origin; or it may be connected with disorder in the cerebral functions, as in hydrocephalus; it is a common, though not an invariable symptom of Amaurosis, due to disease of the retina, or of the third nerve; and frequently it is caused by contusions of the eye, forehead, or temple; often it is sympathetic of intestinal irritation, and it may also be due to rheumatism. The admission of an excess of light to the retina when it is not affected, is found to be a serious inconvenience; and vision is confused and impaired accordingly. The remedial treatment consists in detection of the cause; removal of this, if possible; and subsequent stimulation of the part, by the application of blisters over the course of the ultimate branches of the fifth nerve. Electricity and galvanism have been said to be sometimes useful. Where the contractile function of the iris is not destroyed, the solution of *Physostigma* extract, in glycerine, dropped into the eye, will produce contraction of the pupil in about a quarter of an hour after its instillation. In the idiopathic forms of paralysis of the iris, M. Serres recommends cauterization of the corneal margin by nitrate of silver. In otherwise irremediable cases, palliation results from the use of a magnifying lens, or from contracting the space for admission of light; and these conditions may be combined by a convex glass darkened except at a small round opening or horizontal slit in the centre.

When dilatation of the pupil accompanies amaurosis, of course it cannot be expected to disappear, unless the amaurotic condition have been previously removed; and in all cases, diagnosis and prognosis can only be satisfactorily arrived at by the use of the ophthalmoscope.

Myosis denotes unusual contraction of the pupil. This is one of the consequences of Iritis, as we have already seen; it is a normal condition during sleep, and becomes so at all times in some persons as they advance in life; it may also attend on disorder of the cerebral functions. It occurs, temporarily, where the extract of *Physostigma* has been applied to the conjunctiva; also in cases of opium poisoning, typhus fever, and delirium tremens. When the sympathetic nerve is divided in the neck, the pupil on that side becomes permanently contracted; and in injuries of the spine between the fifth cervical and sixth dorsal vertebræ (*Regio cilio-spinalis*) the same condition is produced. Hence aneurismal tumours of the neck or thorax, affecting these nervous centres, have been noticed to be accompanied by contraction of the pupil.

Sometimes it is induced by habitual straining of the eye on small objects—as in microscopists, engravers, watchmakers, etc. Ordinary and useful vision is necessarily impaired. The means of cure consist in removal of the cause. In the artificers just enumerated, temporary abstinence from the usual avocations will often suffice to restore the normal state; but in most cases of myosis produced by straining of the eyes, fresh air, exercise, and tonics will be found essential to effect a cure.

Tremulous or Floating Iris.—A trembling, or oscillatory movement of the iris, not unfrequently accompanies amaurotic affections; and seems also, in most cases, to be connected with disease of the choroid and softening of the vitreous humour. It is not influenced by treatment; and is chiefly notable as a sufficient contra-indication of operative interference, in connection with cataract and artificial pupil.

Adhesions of the Iris—Synechia—have been already considered. They may be the result of wound, of corneitis, or of iritis. In *synechia anterior*, complete, and accompanied with opaque cornea, cure is manifestly hopeless. When incomplete, and the cornea clear, amendment by the formation of an artificial pupil is within our power. When the adhesion is partial and recent, it may sometimes be remedied by mercurials, and the instillation of atropine to tear up the adhesion, and prevent the permanent adhesion of the pupillary margin to the cornea; where however, the synechia is due to prolapse of the iris into a perforating ulcer of the cornea, such measures are useless. Similar treatment will avail in *synechia posterior*, when recent and partial. But, when complete, it is usually accompanied with opacity of the crystalline capsule and perhaps of the lens itself; under such circumstances, amendment of vision can be effected only by an operation directed against both of these sources of obstruction. In such cases, however, the opacity of the capsule may only be central, and this should be kept in view in the choice of any operative proceeding.

Occlusion of the Pupil.—Artificial Pupil.

The pupillary aperture may be obstructed in various ways. Remaining itself in a normal state, it may be obscured by the cornea which has become simply opaque, or opaque and staphylomatous. Or, the cornea remaining clear, the iris may contract during inflammatory change, and the pupil may become occupied by organized fibrinous product. Or both iris and cornea may undergo serious structural change; as when complete synechia anterior takes place in staphyloma. In the last mentioned case, restoration of sight is manifestly impossible. But in the other examples, something may be done by forming an *Artificial Pupil*.

Before proceeding to any such operation, however, certain circumstances are invariably to be taken into consideration. We should satisfy ourselves that the adhesions of the iris are irremediable by the influence of mercury and mydriatics; that the opacity of the cornea is permanent; that the iris is not affected inflammatorily, and that it retains its fibrous markings; that the lens exists, and whether it is healthy or opaque; that the other parts of the visual apparatus—especially the retina and

vitreous humour—are in a tolerably sound condition, *i.e.*, capable of recognizing light, and the shadow of objects passing between the eye and light; that the eye has not only ceased to be the seat of all inflammatory affection, but, also, that it is not prone to resume this on the application of a fresh exciting cause. An operation is also very properly held to be inexpedient, so long as the patient enjoys a useful degree of vision with the other eye; and it is plainly contra-indicated, when one eye only is affected.

Four distinct modes of operation are practised; all implying interference with the iris—so as to make a sufficient gap in it—opposite a clear portion of the cornea. The desired space in the iris may be obtained by *incision*, *excision*, *laceration*, and *ligature*. Accordingly, the operation is said to be by *Coretomia*, *Corectomia*, *Coredialysis*, and *Triddesis*.

The situation of the proposed new pupil requires consideration. The centre of the iris is of course the best position; but when this is impracticable from central opacity of the cornea, or other cause, the nasal side is to be preferred. It may also be made on the temporal or lower sides; but when placed above the centre, it is apt to be covered by the upper eyelid. A small pupil, too, is generally more useful than a large aperture.

The patient, by careful attention to his general health, should be placed in a condition as favourable as possible for the avoidance of the inflammatory process.

Coretomia, or incision, is performed in cases where the greater portion of the cornea is clear, and where the iris, healthy and unthickened by inflammatory change in its texture, is in a state of tension, with the pupil closed; also where we are confident either that the lens is gone (*e.g.* in cases of great *prolapsus iridis* after extraction), or that there remains merely an opaque capsule. It

may be performed either through the sclerotic, or through the cornea. In operating through the sclerotic, which was the method used by Cheselden and Sir W. Adams, an iris-knife is introduced perpendicularly through this membrane about a line from its junction with the cornea, the cutting edge turned backwards; carrying the point of the

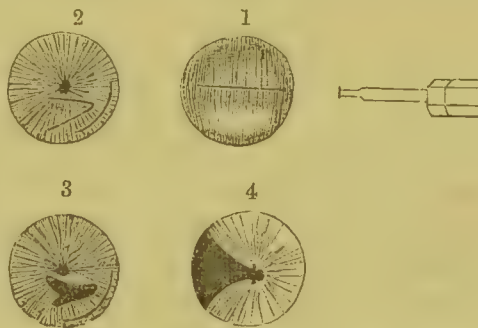


Fig. 257.

knife forwards, it is made to pierce the iris at about a line from its temporal margin; the instrument is then carried across the front of the iris in the anterior chamber, to the nasal side of the cornea (Fig. 257, 1; and, while it is withdrawn, gentle pressure should be made with its edge upon the iris, the tense fibres of which will separate when divided, and an elliptical or ovoid pupil will be the result. The fibres of the iris could be cut to the extent of about a half of the diameter of the membrane. When the lens is opaque, or an opaque capsule is present, this is generally the case, it should be broken up at the same time.

Fig. 257. 1, Coretomia through the sclerotic. The knife introduced—rather far back. 2, Coretomia through the cornea, shewing the lines of the incisions. 3, The eye after the operation. 4, Coredialysis, or separation.—From WHARTON JONES.

In operating through the cornea, Beer passed a lancet-shaped knife through its thickness; then, carrying its point onwards through the anterior chamber, he penetrated the tense iris, near the centre of the cornea; and on the withdrawal of the knife, a horizontal or perpendicular oval slit was found to be produced by the contraction of the radiating fibres of the iris. The method practised by Janin, and perfected by Maunoir, may be employed without injury to a sound lens, and does not require either the same force, or the same healthy state of the iris, to effect the formation of an aperture, as does the operation through the sclerotic. An opening is made in the cornea by a cataract knife, involving about a third of its circumference; into this aperture a pair of fine angularly curved scissors is introduced, the pointed or short blade of which is thrust through the iris, while the blunt and long one is carried between that membrane and the cornea. The scissors are pushed on, till their farther progress is arrested by the junction of the cornea with the sclerotic, when their blades are brought together, and the iris is divided as in the former instance. Or, another incision may be made with them, diverging from the first, and including a triangular portion, the apex of which is near the centre of the iris. The flap so formed will shrivel up in the direction of its base, and leave a sufficient opening for



Fig. 258.



Fig. 259.

the admission of light (Fig. 257, 3 and 4). Instead of the large aperture and the clumsy scissors formerly in use, the needle-pointed canula scissors invented by Wylde, may, with great advantage, be substituted. When there is a synechia anterior with leucoma, involving the pupil by displacing it, the adhesion may be advantageously cut through either with a narrow Beer's knife, or by means of a broad cutting needle knife, or even by the canula scissors, as may seem best suited to the state of the parts. The pupil then becomes restored to its normal site, and so the patient sees past the opacity of the cornea.

Corectomia, or excision, is performed through the cornea, in case where the central portion of that tunic is opaque. *When the pupil non-adherent, and the lens and capsule transparent*, a broad flat needle with cutting edges as far as the shoulder, or the point of a cataract knife is passed into the anterior chamber at the lower or outer side of the cornea. If the iris prolapse, which is not uncommon, it is laid hold of

Fig. 258. Extensive opacity of the cornea. A portion left clear, suitable for an artificial opening in the iris, by corectomia.

Fig 259. Tyrrell's blunt iris hook.

with forceps, and a sufficient portion is drawn out, and clipped away with curved scissors. Should no prolapse occur, pressure on the globe should not be made, but Tyrrell's blunt hook is introduced; and this, having been entangled over the free margin of the pupil, is withdrawn through the opening; the included portion of iris being either excised with scissors, or allowed to rub off with the friction of the lids, after having become strangulated in the wound of the cornea. The excision of the portion of the iris which has been drawn out is always preferable to leaving it to become strangulated in the wound, because, 1st, It may slip from the corneal aperture; and 2d, The inflammatory irritation excited in the partially strangulated iris, may extend to the interior of the eye and destroy the globe. 3d, The presence of the smallest fragment of iris in the wound prevents its accurate apposition and interrupts cicatrization, and therefore may produce a fistulous aperture.

When the pupil is adherent either to the capsule of the lens, or to the cornea, a larger incision than in the former case should be made, near the junction of the cornea with the sclerotic, and through a clear portion of the cornea. The aqueous humour escapes, a small sharp hook, or the manula forceps, is passed through the opening, and fixed in the iris, as near the site of the old pupil as possible, and a portion is dragged out of the opening. When a sufficiency has been protruded, it should be excised with the curved scissors; and the pupillary margin should, if possible, be included in the excised part. This method of operating is also suitable in cases of occluded pupil, when the lens and its capsule are either exempt from implication, or have been affected only within the area of the pupil.

Coredialysis, or separation of the iris from its ciliary attachment, should only be preferred in cases where the cornea is wholly opaque, except a small part at its circumference. Such cases are very unfavourable for any operation, the eyeball being generally very seriously diseased. Having made an opening about two lines in length through the opaque part of the cornea, a fine sharp hook or fine tooth forceps is introduced, and fixed in the iris close to its ciliary border, and at a point corresponding to, but nearer the sclerotic than the clear portion of the cornea. When withdrawn, the iris is torn away from its ciliary attachment till an opening of sufficient size is obtained (Fig. 257, 4); and the portion of the iris which is drawn out of the anterior chamber should be excised. This operation is always a painful one; the site of the pupil is the worst possible, and the risk of copious intraocular hemorrhage is very great.

The operation of *Iridesis*, or ligature of the iris, was suggested by Mr. Critchett, as suitable for all cases where it was desirable to displace the natural pupil. By it the pupillary aperture becomes an elongated slit. It is suited to cases of central opacity, and of synechia anterior which partially implicates the margin of the pupil; and also when the whole pupil has been drawn aside, and vision obstructed by an opacity which overlies its new site. By means of this operation, the size of the pupil can be regulated to a nicety; and this is a great practical advantage gained by its employment. In some cases, when the pupil is not too greatly dragged upon, some degree of natural contraction and dilatation remains. The operation is performed through the cornea.—A puncture is

made sufficient to admit of the introduction of a fine pair of iris forceps, or of the canula forceps; a portion of the iris between the pupil and the ciliary margin, but nearer the latter, in the line in which the displacement is desired to be effected, is picked up and drawn out through the corneal wound. The portion so seized should be about the size of a pin's head. A fine silk thread is now tied round it, so as to retain it protruded until it adheres to the cornea, and remains permanently attached there.

In operating for artificial pupil, if the eye is sound and the operation carefully performed, no bleeding of any consequence ensues, no inflammatory mischief occurs, and when the cornea is healed all danger is past. Where, however, the iris is diseased, thickened, spongy, tearing through like wet blotting paper, a considerable amount of bleeding may ensue, occupying the anterior chamber, and leaving us in doubt, when it has become absorbed, how the result will tally with our expectations. As to treatment, both eyes should be closed with strips of plaster, and kept so for three days. If then there are no traces of inflammatory access, the patient should be kept in an obscured room, and only by degrees exposed to light—a shade, or veil, and tinted spectacles, marking the progressive steps in the process of recovery, while everything that tends to strain the eyes should be studiously avoided for some time to come. Antiphlogistics are quite unnecessary in most cases—good food and tonics being more generally requisite. When, however, acute ophthalmitis sets in, as may take place, then appropriate measures to check its progress must be adopted. It should be remembered that at first the new pupil is always larger and more irregular than it afterwards becomes, and that unless extremely large it is well to keep it as open as possible, by the use of atropine (if the iris responds to its application), so long as any tendency to adhesive contraction continues.

The Ophthalmoscope.

In describing the deep-seated inflammatory and structural changes which occupy the retina and choroid, any enumeration of symptoms which does not include the ophthalmoscopic appearances must be deemed imperfect at the present day. That these may be appreciated, and the instrument itself applied to diagnosis, it is quite essential that its mode of employment should be perfectly understood, and the natural aspect of the interior of the eye as displayed by means of it thoroughly known. Various forms of the instrument have received the sanction of the highest authorities in ophthalmic surgery. All that is essential, however, is a slightly concave mirror about three inches in diameter, fixed upon a handle, and perforated in the centre by an aperture through which the observer may look into the eye in the same axis as that of the light which illuminates its interior. A magnifying lens is also required, so as to increase and concentrate the illumination of the interior of the globe, and at the same time to produce an accurate reflex image of the parts illuminated, which shall correspond with the most convenient adaptation of the visual focus of the observer, the position of the mirror, and the site of the light from which the reflection is produced. This simple

arrangement constitutes the ophthalmoscope of Anagnostakis. The observer must recollect, in employing this instrument, that the optic nerve and retina are seen reversed.

The patient should be examined by gas or lamp light, either in a small room for the purpose, with the walls blackened so that no cross light shall distract the observer, or, though less satisfactorily, in a room with the daylight excluded and a dark surface placed behind him. He should be seated with the head supported, and upon a level a little below that of the observer. The pupil should previously have been fully dilated by means of atropine, and the light should be arranged so as to be situated to one side, a little behind and upon the level of the patient's eye. The surgeon, seated in front, applies the back of the perforated mirror to his own eye, and looks through the aperture while the reflection is cast upon the patient's eye; at the same time, steadying his left hand by placing his ring and little finger upon the forehead, he keeps the upper lid elevated by means of the middle finger, and supports, inclines, and focuses the magnifying lens by means of the fore finger and thumb. To maintain this adjustment, requires some attention and care; but when the art is once acquired it will be found easy of execution, and very much more easily and quickly employed than any of the more cumbrous mechanical appliances which have been invented to serve the same end. At first, nothing but a ruddy glow is seen reflected from the interior of the eye. When, however, the patient turns his eye diagonally across the surgeon, in the direction of his opposite cheek—with a little careful focusing, effected either by advancing or withdrawing the lens, or the surgeon's head and the mirror—the optic entrance situated to the inner side of the axis of vision at once becomes obvious, presenting a creamy but pinkish lustre as compared with the ruddy glow by which it is surrounded—partly due to the capillary net-work of the retina itself, partly to the vascular choroid lying behind it, which the perfect transparency of the healthy retina in no degree intercepts. From the centre of the optic entrance is observed the emergence of the divisions of the *arteria centralis retinae*; sweeping in two or more distinct branches towards and outwards, and downwards and outwards; giving off smaller twigs, both peripherally and centripetally; but leaving the central axis of the eye, or *macula lutea*, always free of visible vessels. These arteries have their concomitant veins following nearly the same course, but are recognisable from them, when compared at their point of emergence, by the double outline and paler tint presented by the arteries. When firm pressure is made upon the eye, a pulsation is produced in both the arterial and venous vessels of the retina. When the focus is slightly altered the choroidal vessels become apparent, hazy, and indistinct in young subjects—especially when of a dark complexion—from the pigmentary elements of this tunic modifying their outline; the ruddy colour derived from their closely-packed arrangement is, however, quite easily recognised. In elderly persons, again, the outline of the vessels is more distinct; and the dusky colour of the pigment, occupying the spaces between them, makes their distribution and appearance more easily studied than in the young.

In a state of health the media, consisting of the cornea, aqueous

humour, lens, and vitreous body, are perfectly transparent, and afford no visible characters.

Affections of the Choroid and Retina.

Choroiditis, Retinitis, Choroido-iritis, Glaucoma, Ophthalmitis.

Although by dissection these affections are capable of classification as different pathological conditions, or at all events as exhibiting different degrees and varying situations of the inflammatory process, in the deeper seated textures of the eyeball—yet as the symptoms are exactly the same in all, we prefer considering them together, under the name of *Glaucoma*, dividing this only into the acute and the chronic. When *Acute*, the symptoms of *Glaucoma* are pain, excruciatingly severe, seated in the globe and orbit, and occupying the frontal, nasal, and temporal regions usually coming on and becoming intensified at night, increased upon pressure, stooping, and motion. The globe feels tense and hard to the touch, sometimes like a stone. The pupil, if non-adherent to the capsule of the lens, becomes fixedly dilated, the lens pushed forwards, the iris of a slate colour, and the anterior chamber diminished in size, or obliterated by the iris coming in contact with the cornea. Vision is impaired from the commencement—sometimes destroyed within a few hours. Bright flashes of light, and black muscæ, seem constantly falling before the eye affected. The cornea loses its natural brilliancy, and appears as if its surface was minutely granular. There is more or less of the sclerotic vascular zone; obscured, however, by conjunctival congestion, and sometimes even by subconjunctival serous effusion. The attack is usually sudden, one eye being first affected; but not unfrequently the other is involved within a few days after. Although the disease usually commences acutely, in many cases dimness of vision, the perception of a halo round gas or the flame of a candle, flashes of light and presbyopia, precede the attack.

The Chronic form always commences with slight dimness of vision, flashes of light, and falling muscæ; and during this stage there may be little or no pain in the eye or head. When the pain sets in, more or less congestion of the sclerotic appears; the iris, too, generally becomes manifestly affected, losing its fibrous markings, assuming a dull slate colour, with radiating veins visible to the naked eye; the pupil is usually more or less irregularly dilated, unaffected by light, and here and there adherent to the capsule of the lens. Vision by the time these changes have taken place is either gone, or so much impaired that only large, brilliant objects can be seen. Then the lens becomes opaque, as if swollen; of a greyish, greyish-green, ochrey, or orange tint. The cornea is dim, reflecting a dull, wavy, and irregular image, as if steamed up to the surface; sometimes it is opaque throughout and as if vesicated; it is also flattened, and its sensibility diminished. The lens and iris are in close contact with it, so that the anterior chamber is gone. The globe feels hard and tense; the sclerotic is more or less discoloured, of a dusky hue, and streaked with large venous trunks emerging abruptly in the ciliary region.

These symptoms may either commence as described, or the acute attack, after lasting for a few days, may merge into the chronic ; or this may pass off altogether, and then the chronic form may be assumed at some further but usually not distant date.

In *Acute cases*, an opportunity is rarely afforded for ophthalmoscopic examination ; and the same is of course true in chronic cases, where the lens has become opaque or the media turbid. When, however, the affection is not so far advanced, or when from suitable treatment the affection has been checked—more or less of black floating specks, threads, or masses, are observed in the vitreous humour ; and when these are numerous, the retina is seen as through a haze or black veil. The textures of the retina appear less transparent than in the normal state ; sometimes hazy and greyish, either in spots, or diffusedly through its texture. Extravasated patches are seen beneath, in, and within the retina. The first are more or less flattened, usually extensive, and generally multiple ; those *in* the retinal substance are usually small, round, and distinct ; those *within* float like a brownish, reddish, or blackish cloud. They may occur in any part, but are most serious, as affecting prognosis, when occupying the visual axis. In an eye affected by an inflammatory process in these textures, the optic entrance appears of a reddish tint, occasioned partly by extravasation, partly by imbibition of the colouring matter of the blood ; there is a varying degree of cupping of the optic nerve, with diminution in size of the arteries contained within it, and lateral displacement of them proportioned to the depth and definition of outline of its margin ; a spontaneous arterial pulse exists in the arteries within the cup, sometimes synchronously affecting their accompanying veins, while at the same time the circulation is easily interrupted by slight pressure upon the globe. The retinal vessels are generally diminished in number and size. Such cases of inflammatory affection of the deep-seated textures of the eye, involving principally the retina and choroid at the outset, are now-a-days, as we have said, usually included under the title of *Glaucoma*—acute and chronic—to which, since the meeting of the Ophthalmological Congress in Brussels in 1857, so much attention has been paid, in consequence of Gräfe's novel proposal for its curative treatment by what he calls *Iridectomy*. The actual starting-point of this disease is not as yet satisfactorily ascertained. Gräfe attributes it to the occurrence of intra-ocular pressure, due to a *choroiditis* or *irido-choroiditis*. By some it has been referred to a gouty diathesis ; but sometimes it occurs without any other manifestation of such a state of system, although it certainly is met with most commonly in persons upwards of fifty years of age, who have suffered previously from some cause of general debility.

Formerly such cases were treated actively when acute ; and when chronic, were either regarded as hopeless, or for a time subjected to the influence of mercurials, iodine, arsenic, and colchicum, singly or combined, in hopes of removing the conditions which primarily excited the inflammatory process. The result of all such treatment was, that within a short period vision became completely destroyed, and after the subsidence of the acute symptoms, a bulging or staphylomatous sclerotic, or a widely dilated iris with a greyish-green reflex from the parts behind the pupil,

or a softened and shrunken globe, proved how vain all these curative efforts had proved.

Gräfe's operation of iridectomy, proposed for the relief of the intra-ocular pressure to which he attributed all these results, consisted in making an opening into the aqueous chamber, through the cornea where it merges into the sclerotic, of such size that as the knife is withdrawn the iris prolapses along with the escape of the aqueous humour. An aperture of from one-sixth to a quarter of an inch in length will amply suffice for this. The prolapsed iris having been picked up by means of forceps, from a quarter to even a third of it is drawn out, and torn away from its ciliary attachment, after marginal division by curved scissors. In operating, it is usually best to put the patient under the influence of chloroform, and to have the lids kept open by means of the spring speculum. The incision may either be made on the outer margin of the cornea, when a linear cataract knife will be found most convenient; or a limited upper section may be made, either with an extraction knife, or with a triangular knife made for the purpose—bent at an angle of 120° to the shank, so as to elude the supra-orbital prominence. The upper lid in the latter operation acts as a covering for the large pupillary aperture, formed after the removal of so considerable a portion of the iris. That the operation has been attended with a success infinitely greater than that of the medicinal treatment before alluded to, and more permanent than what follows mere punctures of the cornea by which the aqueous humour is evacuated, is a fact beyond dispute. But how it does so, or why it should do so, is as yet involved in the deepest mystery. Gräfe attributes the good effects to the permanent relief which it affords to the intraocular pressure; throwing, as he supposes it does, the aqueous and vitreous chambers into one, so as to admit of the fluids effused in the deeper part of the eye being removed by the absorbent powers of the front portion. Such an explanation, however, seems very unsatisfactory. We suspect that the real source of the benefit obtained by the operation, will be found to be exactly in proportion to the extent of the ciliary attachment of the iris which is removed; thus affording a free escape for all fluids which would otherwise have collected between the retina and choroid, or between the latter tunic and the sclerotic. That it has some connection with the ciliary bodies, muscle, or ligament, is obvious, from the fact that by means of Mr. Hancock's operation for glaucoma—in which a common extraction knife is made to divide obliquely for about an eighth of an inch the corneal margin of the sclerotic, without, however, infringing upon the corneal structures—a limited communication is formed between the posterior aqueous chamber and the subretinal and subchoroidal parts. Mr. Hancock attributes the good results which he has found to attend upon the operation, to relief of the undue tension of the ciliary muscle, which exists, according to him, in the early stages of this affection, and to removal of the constriction which the atrophied condition of the same muscle in the latter stages of the disease is supposed to produce. Is this as it may, the operation of iridectomy has, from inexperience, or ignorance, or a blind itching to practice a novelty in ophthalmic surgery, been employed in cases of a very different nature from Glau-

coma; and hence much injustice has been done to a procedure which, when reserved for suitable cases, and those hitherto intractable, is undoubtedly of most signal benefit. It is, however, in acute and sub-acute cases, where the attack is recent, where the vision is impaired but not destroyed, where the tension is great, where the pupillary discoloration is slight, where the anterior chamber still exists, and where the interference with vision is apparently due rather to a muddy condition of the media than to serious retinal and choroidal structural change, that good results can be expected to accrue in the way of the restoration of vision. In other cases, again, manifestly and hopelessly blind, the operation becomes suitable as a speedy and certain means of affording relief from pain; while in some chronic cases, even where the cornea has become considerably opaque, where the perception of light is dim, but where the patient has already lost an eye, it may be prudent to undertake the operation as the only means we possess by which we can hope to save what vision yet remains, and possibly to obtain some small amount of improvement.

These are not the only forms of pathological change met with in the retina and choroid. But as the other affections are unattended with painful or inflammatory symptoms, and we become acquainted with them rather in their results, and from their ophthalmoscopic manifestations, we prefer classifying them under the title of *Amaurosis*. But before leaving the subject of inflammatory affection of the deeper seated textures of the eyeball, of idiopathic origin, it is well to recollect that a *suppurative ophthalmitis*, sometimes attended by very painful symptoms, though more commonly causing but little pain, may occur as an accompaniment of phlebitis, of pyæmia, or of puerperal fever. In such cases, the purulent matter usually collects in connection with the choroid—between it and the retina. Unless the whole globe becomes converted into an abscess, and is attended with suffering so severe as to render the patient more alive to the pain in the eye than to its constitutional cause, or to its accompaniments in other parts of the body, there is no propriety in any interference with its progress. Should any operation be resorted to, it is enough to make a free incision through the globe, for the removal of the cornea, lens, and iris; the case, so far as the functions of the eye are concerned, being desperate.

Amaurosis.

By this term is understood impairment of vision, more or less complete, due to some change in the retina, optic nerve, or brain; the media remaining transparent. The change may be either structural or functional. In the latter case, there is good hope of cure by suitable treatment; in the former, even palliation is often hardly within our power.

The causes are:—change in the retina, choroid, optic nerve, or brain, by the inflammatory process, acute or chronic; compression of these parts in any way—as by extravasated blood, inflammatory product, or formation of a tumour; a congested state of these parts induced by over exertion of the eye or brain, by irregularity of bowels, by habitual ex-

posure to much light and heat, by intemperance, by gout—by, in short, whatever tends to cause determination of blood to the head. Sometimes, on the contrary, amaurosis is caused by want of the circulating fluid in the eye or in the head; as in cases of anæmia from prolonged lactation, profuse uterine discharge, or the like. Wounds of the supraorbital branches of the fifth nerve have often been followed by the disease.

The symptoms are:—impairment of vision, which may be sudden, or gradual and increasing; at first there is perhaps mere obscuration of sight, as if every object was seen through a mist, but this soon gives place to thorough perversion of the function; objects are often seen of erroneous proportion and colour. In the congestive and inflammatory forms, where the retina and choroid are affected, more or less pain is complained of. At first, there may be intolerance of light; but ultimately a glare is borne with impunity, or is rather desired than otherwise. Ocular spectra are frequently seen, either constantly or from time to time, especially after exertion of the eye; they may be dark or luminous, massy or scintillated, steady or flickering. Objects may appear doubled (Diplopia), or only half, or a small portion of an object may be visible (Hemiopia). The pupil is sometimes dilated (Mydriasis). The iris is sluggish, and ultimately motionless; the eye has a vacant staring expression; and the patient acquires a peculiar, uncertain gait. Sometimes the eyeball has a tremulous or oscillatory motion. In such cases the third nerve will probably be found affected from the same cause as has produced the amaurotic symptoms; and if the paralysis becomes complete, *Luscitæ*, as well as the dilated pupil, will be present. Often there is no fixed or decided pain in the part; but rather a sensation of tension and uneasiness. On the whole, the ordinary and characteristic symptoms are, the impairment and perversion of vision, the ocular spectra, and the absence of any appearance of disease of the globe.

Having concluded, after careful examination of both eyes, that the dimness of vision is not due to any change in the transparency of the media of the globe—that in other words the cornea, the aqueous humour, and the lens, are perfectly healthy—the pupil should be dilated with atropine, so as to enable us to decide whether the symptoms are due to changes in the vitreous humour, retina, choroid, or optic entrance. Should we find structural alterations of these textures, then the disease is no longer merely amaurosis, a disease of undefined site, but has a definite lesion, which accounts for the symptoms, and which experience enables us to recognise as due to changes which are or are not capable of being removed, or beneficially affected by treatment. In this way both diagnosis and prognosis is materially assisted; and if more cases of amaurosis are not cured, at least much unnecessary treatment has been avoided, since the introduction of the ophthalmoscope. A brief enumeration of the morbid appearances observed in such cases is all our space admits of. In the *vitreous humour* particles like soot seen suspended in its substance, and float about, as if loosely attached, with every movement of the globe. In the *retina*, white patches and yellowish white spots are frequently observed; the former crescentic in outline, and surrounding the optic entrance, or irregular in form; sometimes of a dead white hue and devoid of vessels; at other times, from effusion beneath it

the retina presents a milky tint with an undulating movement, the retinal vessels coursing over the undulating surface. Again, surrounding the optic entrance, sometimes a faint smear of a blackish hue gradually shades into the healthy retinal tissue. Mingled with the white patches, black spots, punctuate, filiform, or aggregated in masses, are frequently seen. Rupture of a retinal or choroidal vessel with extravasation of blood is a very commonly observed phenomenon ; and when recent the blood will possess its bright red colour. The extravasated patch may be either internal to the retina, or between it and the choroid. The retinal texture in the latter case may be raised up, or it may give way, the blood escaping into the vitreous humour. Sometimes a large portion or even the whole of the retina is separated from the choroid in this way, and floats like a crumpled white sheet attached only by the optic entrance ; still, however, presenting its vessels ramifying over its irregular surface. When extravasations are of old standing, their real nature may easily be misinterpreted. A defined white patch of exposed sclerotic, or a pigimentary stain of a brownish, yellowish streaky, or spotted aspect, alone marks the site.

The entrance of the optic nerve presents very different appearances even in a healthy state. When, however, we find it of extremely small size, irregular in outline, and of dark colour—or when it presents a scooped out or retracted aspect, the edge of the cup standing out in relief, and the vessels turning over the edge with a very abrupt curve—there can be no doubt that its condition is abnormal, and that probably atrophy of its tubular structure has taken place to such an extent that little more than the fibrous tissue of the nerve remains.

Should no such obvious signs of disease be present, we are compelled next to presume that the cause exists somewhere behind the eyeball ; in the optic nerve, in the brain, or in the parts around them. The attack may in such cases have supervened upon some form of fever with head symptoms, or have come on after an injury of the head. It may occur also as the sequel of syphilis, appertaining to the tertiary period of the disease. In a scrofulous habit, tubercular meningitis may have been its forerunner. The presence of other lesions of the extracranial nerves, the appearance of the patient, and the progress of the case, may shew a medullary or other tumour to be the cause of the annihilation of the vision of one or both eyes. Again, there are cases where no symptoms exist which point to any cerebral or orbital disturbance, and where the source of the malady must be sought elsewhere ; the impairment of function being probably due to some reflex cause. Debility, dental irritation, gastro-hepatic derangement, uterine or prostatic irritation, afford illustrations of causes of this form of the disease. The inordinate use of tobacco sometimes produces a like result ; and some poisons specially produce amaurotic symptoms.

As to these there is no uniformity. In most cases, whatever the cause, the symptoms, once well developed, gradually advance to complete loss of sight ; in others, independently of treatment, they reach a certain point and then remain stationary. At other times, uninfluenced by treatment of any kind, they gradually wear away of their own accord.

It must be sufficiently obvious after what has been said, indicating

as it does what a number of tangible and non-tangible morbid conditions are collected together under the title of Amaurosis, that the treatment of the disease must not be one of mere routine. The leeching, blistering, mercurializing, followed by the use of strychnine and tonics, with galvanism, which used, before the introduction of the ophthalmoscope, to constitute the routine practice in such cases, should now-a-days most certainly not be resorted to, unless there is an obvious indication of the presence of some recent inflammatory change in the one instance, or some source of nervous debility in the other, which can be influenced by those remedies. At the same time, it should not be too hastily assumed in our prognosis, that because there is a limited intra-retinal extravasation present there is no advantage to be had from antiphlogistic treatment; for frequently the extravasation is due to the presence of some degree of the inflammatory process; nay, the extravasation may constitute an exciting cause of this; and in such circumstances, under the use of leeching, blistering, and the cautious employment of mercurials, vision has materially improved, the retinal and choroidal congestion has disappeared—the extravasated blood itself remaining long, and apparently only slightly interfering with the integrity of vision. When, however, the central portion of the retina is the part affected, or when the greater part of the retina has been stripped up by the extravasation, though we may prevent further mischief by such treatment, we need not anticipate anything like a restoration of useful sight.

If the disease be apparently but a secondary symptom, as it were, of some constitutional malady—as jaundice or hysteria—that malady is to be thoroughly eradicated from the system, if possible. If intestinal, uterine, or prostatic irritation exist, or be suspected, it is to be treated by the ordinary means. In short, the predisposing and exciting causes should, if possible, be ascertained and removed.

Where the presence of an intracranial tumour may with reason be suspected, no advantage can be derived from any treatment directed towards its eradication; although where it apparently induces attacks of a congestive kind, accompanied with sudden deterioration of vision, benefit will certainly accrue from the application of a few leeches, and the administration of a smart purgative.

The possibility of the previous occurrence of syphilitic infection should never be lost sight of, for in some such cases wonderful results have followed the employment of mercurials and iodide of potassium, with repeated blisters.

Affections of the Crystalline Lens and Capsule.

Cataract.

The term *Cataract* is applied to opacity of the crystalline lens or its capsule. It is said to be *lenticular*, when the disease is situated in the lens itself; *capsular* when the capsule only is opaque; and *capsulo-lenticular*, when both the lens and its capsule are affected. Recent investigation has thrown doubt upon the existence of any such thing as a capsular cataract. In cases of this kind, the superficial lenticular cells

and fibres appear to be the seat of the breaking up of the tissue and fatty product which occasions the opacity. Cataracts then, practically speaking, had much better be described as implicating the *cortical* and the *nuclear* textures of the lens. The former is by far the more common form; in fact the pure nuclear cataract, without the pre-existence of disease of the cortical texture, is very rare. The cataractous change has, by microscopic examination, been proved to consist of breaking up of the fibrous texture of the lens, and in the product in connection with it of fatty matter and earthy salts. The affection may occur at any age, and is attributable to defective nutrition from some cause which, in most cases, is inappreciable. Sometimes, however, the change is evidently hereditary, and due to a gouty diathesis; and we also meet with it as an accompaniment of *diabetes mellitus*. It may be induced by external injury of the part. Sometimes it is a congenital defect. Most frequently it occurs in advanced years; one sign, among many, of the frame's gradual decay.

The prominent symptom is impairment of vision. At first, objects are seen as if obscured by a gauze or mist; this obscuration gradually increases; and ultimately vision is almost, but not entirely, lost. In the most advanced cases, the patient is still able to distinguish light from darkness. The iris is not necessarily impaired in its functions. Both eyes are seldom equally affected at once; but usually both are ultimately involved. Sometimes uneasy sensations are complained of in the eye and forehead; more frequently the part is the seat of no abnormal sensation. Sight is improved by a diminution of light; it is better at twilight than at noon, in a dull than in a bright day, and also better when the patient is seated with his back to the light, than when facing the window; for the pupil, then dilating, permits the rays of light to pass to the retina through the margin of the lens, which is perhaps still unobscured. For a like reason, the use of atropine materially improves the sight. On looking into the eye, an opacity is discernible, occupying the pupil, and situate immediately behind it. This opacity of cataract must, however, be carefully distinguished from the pale yellow tint which the lens possesses normally in adult life, and from the reflex lustre sometimes met with in disease of the retina and choroid. In examining the lens, great assistance is afforded, in the early stages of cataract, from the use of a concentrating glass of an inch focus, held in front of the patient's eye, so as to concentrate the rays of light admitted from a single window. Minute spots and streaks, which produce ever so little interception of the rays, will thus be rendered apparent. To examine the whole extent of the lenticular structure thoroughly, atropine should be applied, to dilate the pupil, so as to afford every facility for ascertaining the extent and character of the change. In proportion as sight is impaired, the opacity is found to have increased. When central or nuclear, it usually presents a uniform cloudy appearance without striæ; but these will very generally be found in the cortical substance, co-existing with the nuclear change. In the congenital form, the affection is mostly confined to the nucleus, but this is by no means the case in adults or elderly subjects. When the disease commences in the cortical portion, it may present a milky appearance without any regular striæ; the superficial cells and

adjacent softened fibres of the lens are then the portions affected ; and this form of cataract may, when further advanced, present a slightly creamy aspect from actual fatty degeneration of the lenticular tissue. Examining the margins of the cataractous lens (and in that portion of it at the lower part of the pupil the change is most easily observed), the altered fibres have the appearance of radiating streaks, those situated anteriorly presenting a convex curved aspect, those posteriorly a concave curve. These striæ are, however, only seen in the early stage of the affection ; as the breaking up of the superficial cells and fibres gives to the lens, as the cataract advances in its development, more or less of a uniform, grey, white, bluish, or amber hue—constituting the *Radiated* form of Cataract. As can be easily understood, in these cases vision will for some time prove better with a contracted than with a dilated pupil.

In examining an eye affected with cataract by means of the ophthalmoscope, no advantage is gained by use of the condensing lens ; the transmitted light at once reveals any opacity which is decided. In commencing cataract, again, the bright glare from the ophthalmoscope sometimes serves to obscure the slight opacities which as yet are alone present, and certainly does not render them so apparent as does daylight concentrated upon the lens with a magnifying glass of about one-inch focus. By means, however, of the ophthalmoscope at this early period, we are enabled to determine the condition of the fundus of the eye, and thus to facilitate our prognosis as to the propriety of afterwards resorting to operative treatment.

Cataracts vary as to density. *Hard* cataract is most frequent in the old ; and is characterized by its brownish, amber, or absolutely black tint. The lens is apparently shrunk in its dimensions, and the greatest amount of opacity is central. The iris is free and movable ; the appearance of a dark ring, from the transparency of the media, surrounding the cataract, is sometimes remarkably distinct. In such cases, vision is improved in the twilight, as also after the use of atropine. *Soft* cataract, of fluid or semifluid consistence, is large and bulging, and completely occupies the pupil. It is most common in the young and middle aged, and is characterized by its bluish-white or milky colour. The iris may even be clogged in its movements, from the increased size of the lens ; and the impairment of vision is great. The opacity is not always homogeneous ; dots or streaks are occasionally observed on it ; and these may change their form and site from time to time, and tend to gravitate downwards. The hard and soft cataract are not, however, different morbid conditions ; for every hard cataract possesses merely the normal density of the lens, its fibres becoming atrophied ; and superficial softening always occurs in every cataract, if only time be allowed for this change to take place. Sometimes the softening becomes complete, the capsule of the lens containing a milky or flocculent fluid. This is called the *Morgagnian* cataract. The appearance presented by this last form so closely resembles that of a lens which has undergone cretaceous change that the only means we possess of making a distinction is by observing whether there is any gravitation of the flocculent particles of which it seems to be composed—this occurring only in a fluid cataract.

Traumatic Cataract may be occasioned by blows upon the eye, or by wound of the globe, in which the capsule of the lens is torn or its structure injured. When it forms, the opacity is attended by swelling of the lens, and gradual solution and absorption of its structures—due to the effect of the aqueous humour upon them.

Spurious Cataract is said to exist, when organised fibrinous product occupies the pupil. This is distinguished from true cataract by being of a yellow or whitish colour; and by the iris being adherent to the lens, besides being puckered, altered in hue, irregular in its pupillary margin, and perhaps bulged forwards into the anterior chamber, from the increased secretion of fluid in the posterior chamber.

Treatment.—Our art has as yet proved impotent, in attempting to stay the progress of advancing cataract; and, when it has fairly formed, no faith need be reposed in any attempts at simple discussion of the opaque structure. Amendment can only be obtained by operation. The obstructing body may be wholly extracted from the eye; or it may be pushed out of the axis of vision; or it may be broken up into fragments, which are expected to be afterwards absorbed; or it may be simply drilled; or it may have its capsule opened, so as to admit the aqueous humour, and thus favour absorption of the crystalline substance. Before any operation, however, is undertaken, certain preliminaries require to be determined. We must first be satisfied that the eye is in other respects sound; so that, when the obstruction to the passage of the rays of light is removed, there may be a fair prospect of vision being restored. There must be no serious disease distroying the integrity of the retina, choroid, or vitreous humour; no ophthalmia, or affection of the eyelids. The iris should be steady, and healthy in colour, acting when light is admitted to the eye; the pupil unadherent; the anterior chamber neither diminished by bulging forwards of the lens, nor unnaturally large in consequence of recession of the pupillary margin. The lens should be fixed, showing no oscillation when the globe is moved. The patient must be free from any marked constitutional ailment, especially of a gouty or rheumatic kind. The state of the atmosphere should be mild and favourable. While there is a tolerably useful amount of vision enjoyed by either eye, it is more prudent to refrain from operation; the results of this being found most satisfactory in cases where vision is so impaired that the patient cannot read, recognise his friends, or go from place to place. One eye only should be operated on at a time. Finally, by careful regimen, hygiene, and medicinal treatment if necessary, the system is brought into a favourable state, and rendered as little as possible susceptible of the inflammatory access.

In the congenital variety an operation should be performed early; otherwise the unsteady rolling motion (*Nystagmus*) which the eyeball is so prone to assume, will prove an impediment to subsequent interference, and to the successful result of operation.

Extraction.—In the operation by extraction, the opaque lens is removed from the eye through an aperture in the cornea—an operation, necessarily comprehending a considerable extent of wound, and no slight amount of injury done to the parts. If, however, inflammatory mischief does not supervene, the result is most eminently satisfactory. But if

acute inflammatory change is set up, or chronic disorganization of the organ ensues; if the vitreous humour escape in quantity during the operation, or the lens pass backwards into the vitreous humour instead of escaping—the eye will in all probability be lost irretrievably. Certain favourable circumstances lead to the choice of extraction. The cornea should be sound, the anterior chamber of proper size, the iris mobile and non-adherent, the globe prominent and steady, the cataract hard. The patient should be in good health; neither plethoric nor weak; so blind of both eyes as to be unable to guide himself in walking, without the risk of running against objects; capable of self-control, and of maintaining the supine posture; free from fatty disease of the heart, diabetes, cough, sneezing, and asthmatic ailments.

The pupil should not be dilated, otherwise escape of the vitreous humour is favoured. Some ophthalmic surgeons, however, prefer to run this hazard, on account of the undoubted facility which the dilated condition of the pupil affords, for making the section without the risk of the occurrence of prolapse of the iris, and its division by the knife. The patient, in a recumbent posture, is placed before a steady light, but with his head slightly inclined from it. The surgeon, holding the knife in his right hand, should be placed either in front or behind, according to the eye which is to be operated on; unless, indeed, he be ambidextrous, when he should always sit behind, and thus himself control the upper lid. An assistant now opens one lid with his fore and middle fingers, taking care to secure it by the margin, so as to prevent this from becoming everted; the surgeon then opens the other eyelid, and steadies the globe, by the fingers of his left hand, applied opposite to the point of puncture; or he secures the globe from rolling by pinching up the conjunctiva in a pair of artery forceps, which he either holds himself or commits to the charge of his assistant, who should remove them just as the section is completed. The section may be *superior* or *inferior*, but the former should always be preferred.

The best knife for the purpose is the triangular one, known as Beer's,

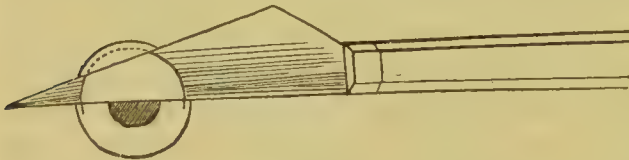


Fig. 260.

or some of its modifications —Sichel's or Bowman's pattern being most suitable. It should be held tightly between the thumb and points of the fore and

middle fingers, the ring and little fingers resting upon the cheek. The flat edge of the point is first made to touch the cornea gently, in order to reassure the patient, and secure steadiness of the organ; it is then entered at about a line from the corneal margin, and passed into the anterior chamber in a perpendicular direction, lest separation of the corneal laminæ should take place from the knife getting between them. Penetration having been effected, the direction is changed, and made parallel to the surface of the iris; the knife is then carried steadily and without lateral deflexion, across the anterior chamber, the point emerging at a spot directly corresponding to that of its entrance; and the steady advance of the instrument is continued, until section of the

Fig. 260. Extraction. The knife cutting through.

cornea is complete. In effecting this manipulation, the phalangeal joint of the thumb should be kept steadily extended, as by this means all lateral motion which would make the section gape is avoided. All pressure is now to be removed from the eyeball. If the aqueous humour escape prematurely, the iris falls forward, and is consequently brought into contact with the edge of the knife. In this case a stop is made; and gentle supporting pressure must be applied to the cornea yet uncut, without, however, withdrawing the knife. This may succeed in replacing the iris, and then section is continued. If not, the knife is withdrawn; the probe-pointed knife is substituted; and with this the section is completed. Or, according to the method of Sichel and others, the operation may be interrupted, and postponed till the humour is reproduced; or the section may be summarily completed—the prolapsed iris thus removed not materially modifying the result.

The corneal section having been satisfactorily made, the eyelids are permitted to close, the eye to rest, and the pupil to dilate. Then, the lids having been gently reopened, the sharp curved needle is cautiously introduced beneath the flap, and as gently as possible made to divide the capsule freely, from margin to margin of the pupillary aperture. The lens then usually, of its own accord, begins to turn out—its upper margin forward—and sweeping over the uveal structure of the iris, appears in the pupil, evolves itself into the anterior chamber, and escapes from the corneal aperture. Should this not take place, laceration of the capsule should be repeated in the opposite direction; and should the lens still obstinately remain *in situ*, while we are satisfied that the corneal opening is sufficiently free, then the slightest possible pressure is to be made on the lower eyelid—over the anterior part of the globe, just below the corneal margin, while with the fingers we steady the globe above—so as to dislodge the lens—and nothing more. Sometimes, unfortunately, the lens, instead of escaping, passes backwards into the vitreous humour. When this occurs, no advantage will follow any attempts to recover and remove it. Also, if with the lens a considerable quantity of vitreous humour escapes, so that the globe collapses, all hope of the restoration of function may be at once given up.

On escape of the opaque body, the corneal flap is properly adjusted, and the eyelids are permitted finally to close. Should the iris have prolapsed, sudden exposure to a bright light will probably suffice for its reduction, by causing contraction of the tissue; if not, gentle friction over the closed lids will reduce it within the cornea. If some of the softened cortical substance of the lens lodge in the corneal wound, this must be carefully cleared away with the scoop, so as to remove what would otherwise prove a certain obstruction to immediate union. A strip or two of court plaster may be applied to the lids, so as to secure them, and thus prevent movement; or gentle support may be afforded, and movement prevented, by covering the eye with a pad of cotton wool retained by a bandage. Sometimes, just as the operation is complete, blood escapes from the pupil, fills the anterior chamber, and flows from between the lids. This may be due to a wound of the iris; more usually it is caused by extravasation into the vitreous humour, occasioned by the giving way of some of the choroidal vessels; and if this latter

occurrence is the case, the eye may be regarded as irretrievably lost. When the operation is concluded, the patient should be laid on his back, with the head elevated; an opiate is given if required; light and all other stimuli are to be rigidly excluded; the ordinary regimen, however, is to be continued, except in plethoric cases—and these should not have been subjected to operation, till reduced to a more normal state; precautions are to be taken against coughing, vomiting, and sneezing; and, if need be, involuntary rubbing of the eye is to be provided against also. The patient should therefore be operated on without chloroform. If possible, the eye should not be uncovered, and exposed to the stimulus of light, for at least three or four days. The symptoms of inflammatory access must be carefully watched—more particularly if characterized not only by temporal and circumorbital pain, but accompanied with swelling of the upper lid, muco-purulent lachrymation, a sensation of grit in the eye, chemosis, a gaping corneal wound, and a hazy cornea. They are to be treated when they occur, not by bleeding, purging, and abstinence, and obviously not by nauseants; nor even by mercury in the early stage, as it is sure to prevent such a process of growth as is necessary for the healing of the cornea. Opiate fomentation, and colchicum, with blistering, are suitable in gouty cases; and quinine, iron, ammonia, and even other stimulants, with a light nutritious diet, appear to act more beneficially where the system is irritable and feeble; when pain is severe, morphia or hyoscyamus must be given freely. In cases which progress satisfactorily, the period of inflammatory risk having passed, the eye is gently and gradually accustomed to its wonted stimulus; but exercise of its full function is to be very slowly resumed.

Linear Extraction is suited for cases of soft or mixed cataract. Its peculiarities are—1st, The incision is made in the meridian of the globe 2d, The opening is smaller than in the operation just described; 3d The lens is extracted piecemeal; either spontaneously escaping in a half-fluid state when the capsule is lacerated, or when too pultaceous in consistence for this, and a hard nucleus is present, removed by means of Gräfe's spoon. In this operation, the pupil should always be dilated. The knife employed for the incision is V-shaped, with a double cutting edge. The spoon is of various sizes, deep, short, on a slender shank, so as easily to contain the nucleus of the lens within its margins, and tilt it out by a gentle rotatory movement while it is supported against the interior of the cornea. By some, laceration of the capsule, and breaking up of the lens into the aqueous humour, is made a preliminary needle-operation, before the linear incision is practised and extraction effected—thus attempting to secure the advantages of the operations of both solution and extraction.

Depression, or Couching, implies downward displacement of a soft cataract, which, from the soft condition of the vitreous humour, it is now found expedient to extract. The pupil having been dilated by atropine the position of the patient is arranged as for extraction. The needle used for this purpose is the one known as Scarpa's, and curved at one point. It is pushed through the sclerotic, on the external side of the cornea, in the transverse axis of the eye, at the distance of a line from the corneal margin; this point being selected in order to avoid

the two divisions of the long ciliary artery, which vessel usually bifurcates at a distance of two or three lines from the corneal margin; also avoiding wound of the retina and of the ciliary body. The needle, having entered, is pushed steadily forwards, between the iris and the lens. By depressing the hand a very little, its point is brought into contact with the upper part of the lens, the concavity of the instrument being opposed to that body. By now elevating the hand, the lens is depressed towards the bottom of the eye, gently and steadily; and the instrument, having been allowed to rest there for a few moments—detaining the displaced body, till the vitreous humour closes over it—is gently extricated and withdrawn. The eye is now closed, cotton wool, with a light bandage, is applied, and the ordinary precautions against inflammatory access are to be adopted, as after extraction.

Comparative facility of performance is in favour of depression. But the objections are, *1st*, the risk of injuring important parts by the needle when its point is out of sight; *2d*, the frequent occurrence of chronic inflammatory mischief, in consequence of the displaced body pressing upon or irritating the retina and ciliary processes, inducing disorganization of the vitreous humour; and, *3d*, the possibility of the lens rising again into the pupil, and obstructing the transmission of light.

Reclination is a modification of depression. The instrument used, and the manner of introducing it, are the same as in the operation for

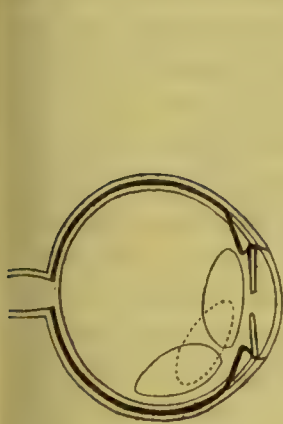


Fig. 261.

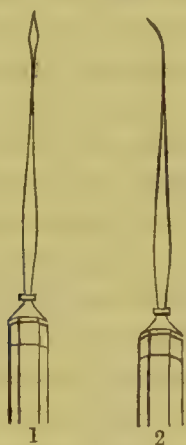


Fig. 262.

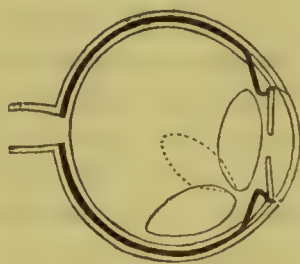


Fig. 263.

depression; but the lens, instead of being completely dislocated and pushed downwards, is simply supposed to be turned backwards into the bottom of the vitreous humour, with its anterior surface directed upwards, and nearly on a level with the lower edge of the pupil. Less injury is done to the retina than in depression; but rising of the lens into the axis of vision is at least equally probable. Accordingly, depression and reclination are now-a-days rarely employed in Europe, for the reasons already assigned; but in India couching is still extensively practised by native oculists—a lancet and a minute flat copper spatula or probe being the instruments employed—and the alleged success which they have in

Fig. 261. Depression.—From WHARTON JONES.

Fig. 262. Scarpa's needle. 1, Front view. 2, Side view.

Fig. 263. Reclination.—From WHARTON JONES.

this operation, has been attributed to the blunt character of the instrument with which the displacement of the lens is effected.

The operation to promote absorption, or *solution* of the lens, is practised when the lens is of fluid or soft consistence, or when, from the symptoms, we know that the vitreous humour is soft, the iris adherent to the capsule, or the case otherwise unsuited for extraction. But by means of this operation any lens may be gradually removed, whether hard or soft. The procedure is simple, safe, and easily performed, but generally requires repetition; and the result is tardy and may be uncertain. The object is, to admit the aqueous humour to a free and general contact with the substance of the lens—a circumstance which experience has shewn to be conducive to its absorption or solution. The operation is performed by means of a needle introduced through the cornea, close to its sclerotic margin. Its point, having reached the pupil, in front of the lens, is made to divide the centre of the capsule by a crucial scratch, and then by a slight rotating motion to break up the lenticular substance. If the lens be fluid, no division of its substance is necessary; it escapes at once like a jet of milky fluid into the aqueous humour, on its capsule being opened, while the crucial flaps of the capsule curl up and retract, leaving a clear pupil. When of soft consistence, a few of the fragments often find their own way into the anterior chamber. Care must be taken, however, not to attempt too much at one time, especially not to dislodge the lens forward in a mass, or in bulky fragments; otherwise an untoward inflammatory process is sure to occur, in the iris and other parts, from pressure of the lens upon them; and absorption is checked so long as this continues.

At the first operation, the lens is divided but slightly. Many deem it sufficient to cut up the capsule only; and certainly it is well not to attempt any displacement. When the operation, however, requires to be repeated, the lens may be more freely broken up. From a few weeks, to two or three months, should be allowed to intervene between the operations; and after each, ordinary antiphlogistic precautions are to be adopted. In congenital cataracts, one such operation usually proves sufficient. When sickness and vomiting come on after the escape of the contents of the capsule of a fluid cataract, paracentesis of the aqueous humour should be practised, with a larger section than is usually required; after which the symptoms will abate.

A modification of this operation, called *drilling*, is suitable where the lens is very hard, but where, for other reasons, solution is preferred to extraction. A needle is entered in the same manner near the corneal margin, and passed through the centre of the pupil into the substance of the lens. Having penetrated into this, to the extent of about a sixteenth of an inch, it is rotated a few times, and carefully withdrawn. The proceeding is repeated from time to time, as in the breaking up; on each occasion that portion of the lens close to the former operation being chosen as the site of puncture. The object is to admit the aqueous humour; and, by its agency on the lens, gradual absorption of that body takes place. In any case, while absorption is going on, the pupil should be kept dilated with atropine. Sometimes, but rarely, this dilatation continues permanent, while vision is unimpaired.

After removal of the lens, in any way, a convex glass requires to be adapted to the eye ; in order fully to restore vision by compensating for the loss of adjusting power. Two pairs of glasses are usually required ; one for reading and working, the other for out-of-door use. This belongs to the department of the optician. Only let it be the surgeon's care not to permit the employment of spectacles, and resumption of the full exercise of the organ, until at least two months have elapsed after the operation—and more especially if that operation have been by extraction ; for not until then will the eye be safe from the risk of inflammatory accession.

Operations on the Opaque Capsule.—If after removal of the lens, by operation, the capsule become opaque, and, occupying the pupil, obstruct vision, or filmy threads stretch across its centre—these may be got rid of in one of two ways. They may be extracted through a small aperture in the cornea, by the canula forceps. Or they may be crucially divided by the needle, or by means of two needles ; and the flaps, or thread-like films, shrinking from the centre, then leave the pupil patent and sufficiently free to admit of distinct vision.

The latter plan, by means of needles, is generally the best suited for selection ; but in rare cases, where a portion of the lens' substance remains persistently in the centre of the pupil, attached to shreds of capsule, the forceps alone afford a possibility of effecting its removal.

Dislocation of the Lens.—This may occur as a result of injury, the lens either being displaced partially or completely. In the former instance, rupture of some part of the suspensory ligament seems to have occurred ; in the latter, the capsule is completely torn, and the lens may then be seen as an opaque object lying in the anterior chamber, or beneath the conjunctiva, having emerged through an aperture in the sclerotic ; or it may even have escaped altogether, along with some portion of the vitreous humour. Such displacements, partial and complete, within the globe, have been met with where they were not referrible to any external injury. Violent sneezing or coughing has been supposed to have given rise to this result. In all such circumstances the lens must be considered as a foreign body ; and when nearly *in situ*, or in front of the iris, or subconjunctivally situated, should be removed.

Affections of the Humours of the Eye.

Hydrophthalmia.—*Dropsy of the eye* may depend on excess of the aqueous humour, of the vitreous humour, or of both.

We have already seen this condition to be the result of inflammatory changes in the sclerotic, choroid, iris, and ciliary body. In such cases the form of the globe may be changed—either regularly, the bluish-black sclerotic projecting between the *recti* tendons—or partially, a cluster of grape-like prominences protruding from some part of the sclerotic margin. The symptoms are those already narrated as characteristic of glaucoma, acute and chronic. In the former, iridectomy is indicated ; in the latter, palliation alone is possible, by evacuation of the redundant fluid—through puncture of the cornea or of the sclerotic, or by incision of the former texture. Sometimes the progress of the disease may be delayed, if not

arrested, by counter-irritation and constitutional treatment. Should the affection, however, continue to progress, and cause sympathetic irritation in the other eye, then extirpation of the globe should at once be practised.

Synchysis Oculi.—The term *Synchysis* denotes a deficiency, and unnatural fluidity of the vitreous humour. When only commencing, the normal firmness of the eyeball is wanting, and the pressure of the recti muscles gives the globe a quadrilateral form, observed when the lids are fully opened. When more advanced, the eye is shrunk and flaccid; the iris is tremulous; the pupil is motionless, and vision is either impaired or lost. Not unfrequently the lens becomes opaque, the pupil may be occluded, and the iris made tense. The disease is usually an advanced result of inflammatory change of the glaucomatous kind, and admits of no treatment, except extirpation of the eyeball, should pain or sympathetic irritation occur.

Wounds of the Eyeball.

These may be incised, punctured, contused, lacerated, and gunshot and are very common causes of acute ophthalmitis. Accordingly, their treatment must be carefully conducted in order to avert disastrous results. In most cases, rest of the globe and lids—secured by a pad of cotton wool or lint, soaked in a weak solution of extract of belladonna, and retained by a bandage—with restriction of diet, rest in the recumbent posture, and exclusion of bright light, is all that is required. If foreign matter lodge in the interior of the eye, antiphlogistics will avail but little so long as the foreign body remains; the globe will suppurate, burst and collapse. It is an important indication, therefore, as soon as possible to ascertain the presence and site of a foreign body, and to effect its removal. But nearly the same difficulty is encountered as in the case of foreign bodies lodged in the brain. It is difficult to ascertain either the site or presence of the foreign matter; and, even when these are plain, it is often very difficult to take it away, without most serious injury to the organ. When it occupies the anterior chamber, or can be seen when the pupil is dilated in the posterior chamber, or even lodge in the lens, section of the cornea, made in such a position as to enable the foreign body to be seized with forceps, is the proper treatment; and the incision may be made either with a linear-extraction or an iris-knife. Where a puncture in the cornea still exists, and the aqueous humour has escaped, if we dilate the pupil, and introduce the blunt cornea speculum so as to steady the foreign body against the inner surface of the cornea, an opening can be made through which the former can easily be removed, without waiting for the healing of the wound, and the reproduction of the aqueous humour. When the foreign body is lodged in the lens, a linear extraction should be performed. Sometimes even a foreign body may be extracted from the vitreous humour, when its position can be seen through the dilated pupil. For this purpose, an opening in the sclerotic must be made, through which the canula forceps are introduced; performing the operation with the aid of the ophthalmoscope. In regard to prognosis, it is important to bear in mind the

there may be foreign matter in the interior of the eye, without any apparent solution of continuity in either the cornea or sclerotic. For, the elasticity of texture may at once close the chasm in the tunic, and conceal it from even minute inspection. In those cases where any considerable portion of the vitreous humour with the lens is lost, there is usually little or no inflammatory disorder excited. But if the lens is dislocated, and retained; if the iris is caught in the wound; if a foreign body has lodged; or if the wound is a puncture, and little of the contents of the globe have escaped—then the occurrence of more or less inflammatory mischief may be anticipated.

Entozoa.—The *Filaria medinensis* has been found beneath the conjunctiva; the *Filaria oculi humani* in the lens. In the latter texture, also, have been found the *Monostoma lentis* and the *Distoma oculi*. The *Cysticercus telæ cellulosa* has more than once occupied the anterior chamber; whence it may be removed by section of the cornea. By means of the ophthalmoscope, it has also been recognised in the vitreous humour.

Tumours.

The eyeball is liable to be the seat of three kinds of tumour; two of these malignant—the medullary, and the melanotic. The third is scrofulous in its nature. The medullary and scrofulous products are most common at an early age, and seem usually to originate in connection with the retina; growing from the bottom of the eye, occupying the chamber of the vitreous humour, and rapidly making way forwards. Loss of vision is early, but not necessarily complete; the visual power of the portion of the retina which is unimplicated in the disease remaining unaffected. The tumour in its first stage can be seen dimly, through the pupil, of a yellowish or pinkish colour, with an almost metallic lustre; while as yet there is no external symptom, the pupil is natural, and neither pain nor superficial congestion is present. In infants and young children it is almost impossible to obtain any satisfactory information with the ophthalmoscope, unless the little patient is first chloroformed. When, however, this is effected, the retina is seen to be elevated from the fundus, not floating, sometimes lobulated, more vascular than in the normal state, of a yellowish tint, and devoid of choroidal vascularity. As the growth advances, the pupil dilates and becomes fixed, the lens from pressure becomes opalescent, and is pushed forwards into the anterior chamber. Now the sclerotic and conjunctiva become congested, the cornea opaque, the eyeball enlarged; intense orbital pain sets in, with copious lachrymation; the patient becomes feverish, loses his appetite and rest, and emaciation commences. The sclerotic begins to enlarge, usually at its upper part, above the corneal margin; an opening forms, the contents of the globe escape, attended with more or less collapse of its tunics, and relief to the pain and feverish excitement which were present. In the scrofulous form the enlargement may now subside; the globe shrinking, until it becomes reduced to a mere button of wasted tunics at the bottom of the orbit. And in some cases this atrophic retrogression takes place even without the globe giving way. In the medullary form, again, when the coats of the eye have yielded,

the tumour increases more quickly than before ; a vascular fungous mass protrudes, and growing rapidly may attain a very large size, before death from hemorrhage, exhaustion, or intracranial extension, carries the patient off. In cases of medullary disease, a cure can be accomplished in but one way—by extirpation of the eyeball ; and that only in the early period, when the disease is confined to the interior of the globe. And it must be recollected, that even after removal of the globe, to which the tumour was apparently limited, the disease frequently returns in the optic nerve ; eventually destroying life. In the advanced stage, all operative interference is contra-indicated ; reproduction then is certain and the progress of the disease, instead of being arrested or retarded, is likely to become accelerated. Indeed, the cases are very few in which the operation has proved thoroughly successful. Once I had occasion on account of false aneurism at the bend of the arm, to tie the humeral artery of a gentleman aged thirty-three, who, at the age of nine, had undergone extirpation of the eyeball on account of what was supposed to be a medullary tumour ;* and in him there has never been the slightest symptom of return ; but in all such cases, allowance must be made for the errors which, in the early stage of the disease, are so liable to be made in diagnosis—mistaking serofulous products for medullary disease, and omitting microscopic examination of the organ after its removal, by which the true character of the diseased structures might be determined.

The melanotic tumour generally occurs after the middle period of life it slowly fills up the interior of the eye ; is seen by the naked eye bulging through the pupil, when dilated, either like the former tumour, with metallic lustre derived from the white retina, or dim and black. It is distinctly visible to the ophthalmoscope, with its pigmentary character more or less strongly marked ; according as the melanotic matter is superficial and subretinoid, or diffused through the substance of the mass. When the globe becomes enlarged and its coats thinned, it is recognised by the dark-coloured external projections of the sclerotic ; and is not attended with pain, tension, and opacity of the lens and cornea. In some cases, care is required not to mistake the disease for simple staphyloma of the sclerotic. The only cure is extirpation of the eyeball ; and this should be effected at as early a period as possible.

In considering the propriety, in any case of abnormal formation within the globe which presents itself for examination, of resorting to extirpation, it is not so much the determination of the essential nature of the tumour which should decide our practice (for in the early stage of the disease that is often impossible), as whether the disease is still within reach of complete removal ; that is to say, is it still confined within the sclerotic ? If the globe is protruded, but not commensurately enlarged ; if any of its motor muscles are paralysed ; still more if the globe is fixed, or its movements impeded in any particular direction and most specially, if the finger cannot press deeply round it on account of some mass which occupies the orbit—it is obvious that the disease is beyond our reach, and no operation should be attempted. Even in cases where, with the absence of every such untoward symptom, removal

* Edinburgh Medical and Surgical Journal, vol. xix. p. 51.

the globe has been effected, and to the naked eye the optic nerve appears quite sound, the microscope often shews the existence of cancer cells in the connective tissue of the neurilemma of the nerve.

Extirpation of the Eyeball.

This operation may be required on account of disease in the globe irritating the sound eye; tumour of the eyeball; tumour of the orbit, involving the globe secondarily; cancerous ulceration of the eyelids, involving the globe, or implicating the eyelids extensively—as formerly explained.

If the globe and contents of the orbit are to be removed, the commissure of the eyelids having been divided, at the outer angle, so as to afford space, the mass is laid hold of by a volsella; and by this instrument it is steadied and directed throughout the remainder of the procedure. By means of curved scissors with probe points, the globe's muscles, and so much of the contents of the orbit as may seem desirable, are successively divided; last of all, the optic nerve is cut across, and the mass withdrawn. If the lachrymal gland have escaped the general clearance, it may be seized by the forceps and clipt away; but this is not absolutely necessary.

If the globe alone is to be removed, which usually is all that is wanted, we proceed as in the operation for strabismus; dividing the conjunctiva over the internal rectus, and passing the squint-hook beneath the tendon, which is cut through. The insertion of it may then be seized in the teeth of a pair of artery forceps, and confided to an assistant to steady the globe, while the operator divides each tendon along with the superjacent conjunctiva in turn, till at length the globe starts from its socket. The optic nerve is last of all cut through by means of a pair of curved blunt-pointed scissors made for the purpose; and the eyeball is thus excised, leaving the other contents of the orbit intact. Having become satisfied of the entire removal of the diseased structure, the cavity is sponged clear of blood; drossils of dry lint or charpie are placed so as to fill the orbit and project somewhat beyond the margin, and a retaining bandage is passed around, with sufficient firmness to arrest arterial bleeding. After a few days, the dressing is gradually undone and removed; suppuration is established; granulation succeeds; and the granulating wound is to be treated in the ordinary way. Where, however, the globe alone has been removed, and the bleeding ceases spontaneously, or can be arrested by a single ligature, the conjunctiva may be laid down, or approximated by points of silk suture; union of it by the first intention occurs, and the healing process is thus hastened, rendering the operation comparatively simple and devoid of risk. After cicatrization, an artificial eye may be adapted to the socket.

Congenital Deficiencies of the Eyeball—Complete and Partial.

An interesting example of *Anophthalmos*, or a complete deficiency, occurred to me some years ago. A girl, strumous, and of strumous parentage, laboured under conjunctivitis, which proved very obstinate,

and had already produced considerable opacity of both corneæ. The mother, naturally of an anxious temperament, had her every thought engrossed by the state of this child—then an only one. She again became pregnant; and still persevered in her watchful nursing unweariedly, and, if possible, with an increased solicitude. The second child was born at the full time. It proved a male, well-formed, and seemingly perfect in every way. But, on opening the eyelids, not a vestige of either eyeball could be found. The lids were perfectly normal in both form and size, but gave no sign of globular projection beneath; and on opening them, red, fleshy, mucous-looking membrane, flat and loose, was found to be the apparently sole occupant of the orbits. As the child grew, the congenital deficiency remained unaltered.

The difficulty, however, in all such cases, is to be certain, without dissection, that no rudimentary organs exist; which, although arrested in their growth, are only hidden by the areolar tissue of the orbit and conjunctiva by which they are surrounded. Still, as dissection has proved that with a well-developed head, not only may there be anophthalmos, but entire absence of the optic nerves as well, there seems no good reason for refusing this example a place in the list of several such cases which have been noticed from time to time. But partial malformation of the globe, or some of its parts, is very much more common than complete absence of the organ.

The development of the whole globe may be small in proportion to the general bulk. This is called *Microphthalmos*. The conjunctiva may consist of a smooth dry inflection of the cutaneous surface, the superficial layer of the cornea being similarly constituted, and no lachrymal secretion moistening the surface. This is called *Xerophthalmos*. The iris may be absent—a condition designated *Irideremia*. The absence of the coloured portion of the eye, the ruddy glow from the fundus, the rolling movement of the globes, and the golden rim of the lens, will usually attract the attention of the practitioner at an early period to this state of matters.

The development of the iris may be imperfect. In *coloboma iridis* the coalescence of the two halves of the iris remains incomplete. The pupil is, in such cases, of an oval or elongated form, and extends towards the lower margin of the cornea. This may be more or less marked, and usually occurs in both eyes.

The position of the pupil, which normally is not accurately central, but a little to the inner side of the centre, may be quite eccentric, near the corneal margin. Sometimes there is a *duality in the pupils*; and there is then a *central* as well as an *eccentric* pupil. When the iris has no pigmentary deposit in its textures, it seems from the absence of the *uvea* to consist of a network of interlacing fibres, through which the ruddy colour of the fundus can be recognised. Such cases occur in persons who have a similar deficiency of colouring matter in the hair and skin, constituting the condition of *Albinism*. Vision in such cases is usually indistinct, from the passage of light not only through the pupil, but through the iris as well, interfering with the refraction. The *lens* may be completely wanting from congenital defect. A case of this kind (complete *Hypermetropia*) in a medical student lately came under my observation.

Vision was so extremely feeble, that I was consulted as to the propriety of his abandoning his studies. On examining the eyes, the anterior chambers were large, the pupils and irides normal. When the pupils were dilated with atropine, the fundus of each eye was easily inspected by means of the ophthalmoscope, without the aid of the condensing lens, and vision was rendered perfect by employing the deepest cataract glasses. The lens may be partially displaced. Mr. Dixon mentions an interesting example of this in four members of the same family (Ophthalmic Hospital Reports, vol. i., p. 54), and says he has met with another example of it in a boy (p. 57). Gräfe, in the Archiv. für Ophthalmologie, vol. i., p. 345, records another example.

Various abnormalities in the development of the optic entrance and retina have been observed, more especially since the introduction of the ophthalmoscope as a means of investigating the condition of those parts during life.

Strabismus.

Squinting depends upon a want of harmony in the action of the corresponding muscles of the two eyeballs, so that when both eyes are directed towards the same object there is a want of parallelism in their visual axis. That there is no real loss of equilibrium in the opposing recti of the squinting eye, is obvious from the fact, that when the sound eye is closed the squinting one becomes straight; again assuming its distorted direction when the sound eye is opened. The want of parallelism is really still present, but becomes transferred to the closed eye; as can be seen by opening it suddenly; then it will be found distorted precisely as the squinting one had been, while it immediately becomes straight when the squinting is resumed by its fellow. Strabismus may be either *convergent* or *divergent*. In the former, the axis of the affected eye or eyes is directed towards the nose; in the latter, outwards towards the temple; the former is the more common—the latter, especially those cases which admit of operative treatment, very rare. If the obliquity is confined to one eye the squint is said to be *single*; when both eyes are affected, *double*—in which case the distortion usually alternates. The squinting eye is usually a weak one, so far as vision is concerned; the deficiency sometimes consisting in the eye being *myopic*, while in other instances it is defective in its power to distinguish minute objects (*Asthenopia*). This weakness has been regarded by some as the cause, by others as a consequence, of the squint. If it be the cause, then the squint occurs as a means of rectifying the indistinct vision produced by the healthy and weak eye acting consentaneously; the weak eye being put out of the visual axis. This would account for those cases of squint which occur as a consequence of slight nebula of the cornea, and for those instances where one eye is long-sighted and the other short-sighted, and where the squinting eye alternates as distant and near objects are examined. But this explanation will not suffice to account for those cases where the performance of the operation, required to rectify the obliquity, at once restores perfect vision to the eye, which previously could scarcely recognise the presence of lines in a printed page. Here the squint, or something connected with the displacement (*Hypermetropia*), must be the cause of the impaired

vision, as mere disuse of the eye could not tally with the instantaneous improvement in such cases, which is found to follow the operation. On examining a squinting eye with the ophthalmoscope, a contracted, oval, dark-coloured optic entrance is generally recognised, which, being probably a congenital malformation, may help to account for the occurrence of strabismus in different members of the same family. Other more



Fig. 264.

marked structural lesions of the choroid and retina may however be present, and when this is the case the source of the imperfection of vision is all too obvious, and of course cannot be expected to be remedied by operation.

Strabismus may be congenital, but usually makes its appearance about the third or fourth year. When temporary, it may be traceable to the cerebral excitement present during dentition, to gastric and intestinal irritation, to febrile excitement, or to general debility; and by attention to the treatment of these affections the squint will disappear. Should it be slight in degree and variable in intensity, then by binding up the sound eye, and exercising the one which squints, advantage may be obtained. Where one eye is short-sighted (myopic) or hypermetropic, the adaptation of a concave or convex glass to suit the condition will usually reproduce parallelism of the optic axes. When no such conditions are present, or when in spite of their removal the squint remains; when there is no opacity of the cornea, and no serious structural lesion of the interior of the globe, as seen by the ophthalmoscope; when the brain, nerves, and orbit are sound; when the vision of the affected eye is only impaired, not destroyed—amounting, perhaps, only to a mere perception of light—then the operation for strabismus should be recommended, and resorted to as early as possible, so as to secure for the patient the advantage of binocular vision, at a period when his education is only beginning.

The operation for strabismus consists in the division of the *internal rectus* muscle of the eye, or eyes, affected in the *convergent* form—of the *external rectus* in the *divergent* form. This operation, though probably resorted to in the last century, was first executed upon any definite principle by Dieffenbach in 1839; and since that time has been recognised as one of the regular operations of surgery, requiring however surgical skill and careful diagnosis for its suitable and successful employment. As performed by Dieffenbach, the operation was as follows:—A fold of conjunctiva, midway between the cornea and the semilunar fold, about $\frac{3}{4}$ th of an inch from the former, having been seized and elevated, by means of common dissecting forceps, is divided by a stroke of the scissors. By one or two touches of these, aided by the forceps, the subconjunctival areolar tissue is cut, and the tendon exposed—at that point where it is inserted into the sclerotic. It may now either be gathered up by the forceps, or elevated on a blunt hook passed beneath, and completely divided. And it is well to make, at the same time, a

Fig. 264. Plan of the eye, showing the line of incision in the conjunctiva, in the operation of Dieffenbach.

clean dissection of the sclerotic, for some little distance on either aspect of the tendon; so as to divide any bands of fibrous or areolar tissue, which might otherwise act retentively on the malposition of the eye. If the globe prove unsteady during the operation, it may be expedient to control its motions by means of a sharp, short, double hook, or artery forceps, inserted into the sclerotic conjunctiva near the corneal margin, on the outer side. The operation over, and all the instruments withdrawn, the patient is directed to look as he formerly squinted. If he find a difficulty in re-effecting the displacement, the immediate result of the operation may be considered as fully attained. But, otherwise, it is necessary to make a more free division of the textures implicated; in all cases, however, taking care not to occasion an unseemly exophthalmos, by carrying such division to an undue extent. The retraction of the semilunar fold which follows this mode of operation, giving the eye an appearance of undue prominence, has led to what is called the *subconjunctival* operation. This consists in making the incision with scissors parallel to the horizontal axis of the globe, below the level of the rectus tendon; having divided the areolar tissue beneath the conjunctiva, a director, or squint hook, is slipped upwards beneath the tendon, which is divided by means of blunt-pointed iris scissors, or by the curved blunt-pointed bistoury which used to be employed for extending the corneal aperture in extraction, and in which the cutting edge is on the concavity. Various angular and curved knives, however, have been devised for this part of the operation. The difficulty with all of them consists in effecting complete division of the tendon. To secure this more thoroughly, Gräfe has recommended that the incision should be made along the line of the tendon; *i.e.*, on the equator of the eye. The tendon, having been thus exposed, is to be drawn out through the wound, either with forceps, or by drawing the conjunctival margin of the incision downwards with the point of the squint hook; the point of which, dipped beneath the lower margin of the tendon, is passed upwards till it reaches the tendon's upper margin, and shines through the conjunctiva; the point is now turned downwards, till it appears in the wound, and the tendon thus drawn out is then divided by means of scissors. A point or two of fine silk suture may be introduced, if required to approximate the edges of the conjunctival incision. Usually, however, all that is needed is to cover up the eye for a day or two; and keep the patient on a restricted diet. Inflammatory consequences seldom occur. The wound usually unites by adhesion. In the ordinary operation, it more frequently heals by granulation, and then generally a fungous button-like growth forms; which should be removed by fine curved scissors, and prevented from again forming by the occasional instillation of a few drops of a weak solution of nitrate of silver. After a few days, the functions of the eye are to be resumed; and they should be so arranged as to give the organ a habitual movement in the direction opposite to that whereto it was formerly directed. Indeed, this exercise or training of the eye, subsequently to the operation, is a very essential part of the treatment; and should be begun at an early period after the operation.

Sometimes it is sufficient to operate on one eye only. At other times we are compelled to operate on the other eye as well. For, when both

eyes are implicated in squinting—though in very unequal degrees—it will be found quite impossible to restore parallelism in position and motion, if the myotomy be limited to that organ which is most prominently affected. In most cases, however, it is unnecessary to operate on the second eye, until we see the effect produced by what has been done to the first.

In operating for strabismus, except in nervous females, children, or unusually sensitive patients, it is much better not to give chloroform ; as it delays the operation, and prevents the effects of the division of the tendon from being recognised, till the anæsthetic effect has passed off. In keeping the lids open, specula of different kinds may be employed ; but the spring wire speculum is best suited for the purpose—not interfering with the manipulations of the operator, as the hands of an assistant necessarily do.

Occasionally the cure is more than complete ; squinting in the opposite direction being threatened. And were the other rectus muscle now to be divided, unseemly projection of the eyeball could not fail to be produced. Should this result occur, it is sufficient in most cases to excise a portion of the conjunctiva on the site of the divided muscles ; the contraction produced by sutures—or of the sore, in healing—sufficing to restore the normal position.

Exophthalmos.—Protrusion of the Eyeball.

Undue prominence of the globe may be produced by different causes. Inflammatory, dropsical, or bloody effusion into the areolar tissue of the orbit we have seen may occasion it. Tumours within the orbit produce it ; and in all such the globe retains its normal bulk, although pushed forwards from behind. In some cases there is, at the same time, from the position of the tumour, some lateral displacement. Chronic inflammatory changes, and morbid growths within the globe, ultimately produce an undue protrusion of the eye ; but in such cases the globe itself is enlarged. The term, however, of *exophthalmos*, as employed at the present day, is generally intended to designate those anomalous cases, where, in an anæmic patient affected with palpitation, and more or less enlargement of the thyroid gland, an unnatural protrusion of both the eyeballs appears to constitute the entire disease. Various explanations have been adduced to account for this condition ; as, for example, distension of the orbital arteries and veins, or effusion of serum into the areolar tissues of the orbit ; and these conditions have been supposed to be due to pressure of the enlarged thyroid on the deep veins of the neck, or to be occasioned by some cause interfering with the sympathetic nerve, or with the posterior roots of the upper intercostal nerves, or with the Casserian ganglion. Vision, in such cases, may either be normal, or very defective. The treatment consists in the employment of measures calculated to cure the goitre, and relieve the anæmia and palpitation ; as iron, belladonna, and valerian. As the patient's general health improves, the exophthalmos usually abates ; vision, however, when impaired, is but slowly restored.

Affections of the Nerves of the Orbit.

The sensibility and nutrition of the eyeball, and its appendages, are dependent upon the integrity of the fifth nerve. Hence we have orbital and ocular neuralgia due to some perversion of its function ; and opacity and ulceration of the cornea are produced by any cause which completely interrupts its function.

We have the orbit and its contents also affected, so far as movement is concerned, by the normal or abnormal conditions of the *portio dura* of the seventh, and more importantly by the condition of the trunk of the *third, fourth, and sixth nerves*, or of their centres of origin.

When the eyelids on one side cannot be closed, and the lower lid hangs flaccid, this is due, if no mechanical obstacle to closure is present, to paralysis either of the trunk of the *portio dura*, or of its branch to the *orbicularis palpebrarum*. If not occasioned by injury, its most common cause is exposure to cold, either acting directly or reflexly through the medium of the fifth nerve. Blistering of the cheek, temple, and forehead, with the use of anti-rheumatic remedies, will usually be found of most service.

Paralysis of the *third nerve* is indicated by a dropping of the upper eyelid, permanent eversion of the globe (*Lusitas*), inability to move the eye upwards or downwards, dilatation of the pupil with indistinct vision, and *diplopia* when looking straight forward, or to the side opposite to that to which the affected eye is turned, with a slight divergence from the perpendicular—the image seen by the affected eye being above that seen by the sound one.

Paralysis of the *sixth nerve* produces loss of power of the external rectus ; the globe is permanently inverted, and while it executes every other movement, it cannot be everted. There is *diplopia* when looking at objects towards the side affected.

Paralysis of the *fourth nerve* is a rare affection. The superior oblique muscle is then rendered powerless, and the patient complains of seeing all perpendicular straight lines, such as the line of pavement, become double ; the distorted image forming an acute angle with the true one, and the lines of any geometric figure containing right angles becoming double, with the second image distorted, so that the lines lose their parallelism.

When one nerve after another becomes affected, the disease is in all probability due to some deep-seated growth—either intra-cranial or orbital. When cerebral symptoms are present at the same time, the diagnosis is simplified. When the globe protrudes, the existence of an orbital tumour connected with the fundus of the orbit is rendered almost certain. When the affection is limited to one nerve, and comes on suddenly in an elderly patient, after some sudden effort, an apoplectic affection of the origin of the nerve is indicated. The great majority of these cases, however, occur in syphilitic or rheumatic patients, and affect only one nerve at a time. While, then, the prognosis in the former cases should always be studiously guarded, in the latter (syphilitic and rheumatic), especially in the syphilitic, if coming under treatment at an early period after the appearance of the original affection—it should always be hopeful ; as under the administration of mercurials, followed by the iodide

of potassium, and the employment of counter-irritation externally, over the temple, forehead, and mastoid region, a complete restoration of the functions of the affected nerve may be anticipated. When the muscles affected regain their contractility but slowly, Faradisation, or electro-galvanism, will be found to afford beneficial results.

Affections of the accommodative and refractive power of the Globe.

1. *Myopia*, or *Short-sightedness*.—In this the eye is naturally adjusted for divergent rays; its refractive power when in a state of repose being too great, or its antero-posterior axis too long, and the focal point of its dioptric system falling in front of the bacillar layer of the retina. Such patients, while they can observe very distinctly the smallest objects close to the eye, can see nothing, or but indistinctly, at a distance; while vision for distant objects is perfectly corrected by means of *concave* glasses. The ophthalmoscopic inspection, at some distance from the eye, of the fundus of the globe, without the convex lens, displays the reverse image of the retinal vessels and optic disc. The myopic patient should be supplied with spectacles with *concave* glasses, suited to the degree of his *myopia*; stronger for distant, weaker for near objects.

2. *Presbyopia*.—The adjustment in this affection for distant objects is normal, while the power of accommodation for near objects is diminished. The patient—who is usually above forty—therefore holds small objects away from his eyes, and brings them near a bright light to improve the distinctness of vision. If this change is gradually induced, it must be regarded as normal; accompanying advancing years, and due to the increased firmness of the crystalline lens. When rapidly induced, it is frequently a premonitory symptom of glaucoma. In the former case, convex glasses should be supplied; in the latter, the intra-ocular pressure should be relieved, and all use of the eyes discouraged.

3. *Hypermetropia*, *Hyperopia*, *Hyperpresbyopia* — “Oversightedness.”—Here the refractive power of the eye is too low, or the optic axis too short. The globe seems flatter and smaller than in the normal state, and the outer canthus seems too full. Neither parallel nor divergent rays are brought to a focus on the retina; the focal point of the dioptric system falling behind the bacillar layer. The power of accommodation is usually good, while the refractive media are too low in their natural conformation. Vision is feeble, and the eye easily fatigued. By the ophthalmoscope we see, without the convex lens, an erect image of the fundus of the eye, in which the optic disc and retinal vessels seem to move in the same direction as the head of the observer. In such cases, convex glasses are required; one set for reading and inspecting near objects; the other weaker, for distant objects. In selecting these, we should first paralyse the accommodative power by means of atropine.

CHAPTER XXXIV.

AFFECTIONS OF THE NOSE.

Wounds of the nose, dividing the ala, and penetrating into the nasal cavity, however produced—whether by accident or in the performance of operations, or as a punishment, according to the custom of some half-civilised nations—heal perfectly ; and, if the edges of the wound have been brought into accurate apposition by means of sutures, with but little if any scar. Should such wounds have been permitted to cicatrize without apposition, so that a slit remains, the margins of the cleft should be removed with the bistoury, and sutures introduced to bring the edges in contact. When the nose has been detached from surrounding parts except by a narrow neck of sound texture, it usually retains its vitality, and will adhere if suitably treated. It is scarcely necessary to refute the fabulous accounts which once obtained credit, of noses bitten off or otherwise completely severed, being capable of uniting if placed in careful contact with the bleeding surface from which they had been removed.

Fracture of the Nasal Bones.

Fracture of the nasal bones is always the result of external violence, directly applied. The injury may be either simple or comminuted ; and the latter form is of frequent occurrence. It may also be either simple or compound ; and the latter form may be constituted by wound of the integument, or by laceration of the mucous membrane, or by a combination of both conditions. There may be no deformity present, the bones resuming spontaneously their normal position. When, however, displacement remains, then deformity is the prominent feature of the injury. When comminution exists, the slightest manipulation suffices to detect crepitus ; but this is frequently simulated and accompanied by the emphysematous crepitation of the areolar tissue of the cheeks and eyelids, which is usually produced by the efforts of the patient to blow his nose, when the blood comes trickling down the nostril from the lacerated mucous membrane. There is always more or less swelling and discoloration, which may obscure the displacement of the bones. When this is the case, careful manipulation should be employed to determine the existence of the fracture.

Replacement is easily effected, by passing the closed blades of a pair of small dressing forceps, or the ordinary polypus-forceps, or a director, female catheter, or such like instrument, into the upper part of the nostril, so that the broken bones may be forcibly elevated to their normal level, at the same time modelling the fragments into their proper place

by the fingers of the other hand applied externally. Sometimes, indeed, it may be in our power to improve on the original elevation, and to impart to the organ a more pleasing contour than it originally possessed. This replacement should of course be effected as soon after the accident as possible ; but where the case has been neglected or mistaken, readjustment after breaking up the deformed union may be effected, under chloroform, even months after the infliction of the injury. If any small fragments be completely detached and exposed, they should be at once removed. No retentive apparatus is necessary ; for redisplacement is not likely to occur, unless under reapplication of external violence. But if bleeding prove troublesome from the membrane, it may be necessary to plug the anterior nares with lint. If there be wound of the soft parts, it is treated according to ordinary principles. And, in all cases, the requisite precautions are put in force against the accession of the inflammatory process, and the risk of erysipelas.

Lipoma of the Nose.

By this term is understood a hypertrophied condition of the integument and subcutaneous tissue of the apex and alæ ; usually occurring in males of advanced years, who have lived freely. The skin is thickened



Fig. 265.

and opened out in texture ; the sebaceous follicles, in some cases, being very much enlarged. The growth sometimes attains to a great magnitude ; and the large pendulous masses present a reddish-blue, or purple colour, with large tortuous veins ramifying over the surface. When the enlargement is partial and of no great bulk, or only commencing, no

Fig. 265. Lipoma of the nose.

operative interference is required. It is sufficient to attend to regimen, and to the state of the general system, so as to prevent, if possible, further growth; and direct treatment, in the form of astringent and stimulating lotions or ointments, may be applied to the organ itself, with a view towards restoring it to a normal state. But when the growth attains to the magnitude of a pear or egg, and several such masses hang in pendulous clusters over the mouth and chin, they prove so serious an inconvenience, obstructing vision, and interfering with eating, drinking, speaking, and breathing, as to require surgical interference. In such circumstances, the redundant growth should be carefully pared away. A finger having been placed in the nostril, so as to distend the part, and facilitate dissection—while the risk of cutting through the cartilage is avoided—the knife and catch-forceps, if need be, are carefully used, so as to remove the whole of the morbidly altered structures. The bleeding is mostly venous, and though considerable, is easily checked by cold or pressure. Sometimes the parts are so dense as to preclude the use of ligature to the arterial points; in which case, if pressure fail, the needle and twisted thread may be employed. Cicatrization is usually rapid; and, when completed, satisfactory. Apparent reproduction may, however, take place, by the surrounding integument, formerly unaffected, becoming similarly diseased; the cicatrix itself usually remains firm and depressed.

Morbid Expansion of the Nose.—Sometimes the extremity of the organ becomes developed altogether out of proportion to the rest of the features, and thus constitutes a deformity of a more or less rounded form, in which all the tissues, and not merely the skin, appear to have become morbidly developed. In such cases the removal of a wedge-shaped portion of the extremity of the nose, including the growth, has recently been practised by Mr. Syme with satisfactory results, more particularly regards the improved personal appearance of the patient. After the wedge-shaped portion has been taken away, silver wire sutures are introduced, and the part heals readily by the first intention.*

Polypus of the Nose.

Nasal polypi are of various kinds; simple-mucous, and cysto-mucous; fibrous; and medullary. The first are, fortunately, of most frequent occurrence; and usually are found to be developed from the investing membrane of the superior turbinated bones.

The symptoms of the common mucous polypus are sufficiently characteristic. The patient feels that something unusual, and apparently fleshy, is occupying the nostril; calls to blow the nose are unusually frequent, and can be but imperfectly obeyed—passage of air through that nostril being found to be much obstructed; there is a preternatural amount of mucous discharge from the part; on attempting to blow the nose, a great portion of the mucous secretion is thrown into the pharynx; there is a constant feeling as if there existed “a cold in the head;” very frequently, there is lachrymation, the extremity of the nasal duct being compressed by the growth, or the lining membrane of the duct being sympathizingly involved in congestion; and these uncomfortable circumstances are all

* Syme's Observations in Clinical Surgery, p. 203.

aggravated in damp and variable weather. On looking into the nostril, the anterior portions are seen ; and, when the speculum is used—or rhinoscopy practised from behind, by means of the laryngoscope apparatus—a very distinct exploration of their bulk and form may in most instances be effected. When the mass has attained to some considerable size, it may render itself apparent, by projecting externally. When it is developed posteriorly, deafness is frequently noticed, occasioned by pressure on the Eustachian tube ; and giddiness may also exist, which some have attributed to compression of the jugular. The sense of smell is necessarily much impaired ; and so in many cases is that of taste. Speech is indistinct, and snuffling. In sleep the patient snores. When both nostrils



Fig. 266.

are affected, the patient is unable to keep the mouth closed, else respiration would be stopped. The tongue accordingly becomes dry and altered in its appearance, and more or less gastric irritability may result. But as all these changes occur gradually, their presence may be unobserved and little or no discomfort complained of. After a time, the feature may undergo a change ; the nasal bones becoming gradually expanded giving a very unpleasant breadth to this part, and establishing the condition which is ordinarily termed "Frog's Face." Then certainly, and

Fig. 266. Frog-face ; the polypi causing much deformity by expansion of the bones and change of relative position in the soft parts.

often also at an early period of the case—pain is complained of in the head, especially in the forehead.

In the minor cases, it is essential that diagnosis be accurate. Symptoms are not trusted to alone. The speculum or finger must be employed, so as to explore the nasal cavity ; enabling us to ascertain whether the obstruction depends on nascent polypus or not. For the disease is apt to be simulated. There may be merely a general congestion of the lining membrane. Or there may be a bulging of the septum to one side, with or without congestion of the membrane on the convexity of the bulge. There may be abscess forming between the septum and its investing membrane. Or there may be a hypertrophied condition of the spongy bone. Any of these circumstances may produce more or less occlusion of the nostril, increase of secretion, snuffling of speech, and to some extent the symptoms of polypus. By use of the speculum, or the introduction of the finger well-oiled, if the opening of the nostrils will admit it, the true condition of parts may easily be determined.

If there is no polypus, no operative interference is required. For congestion, abstraction of blood and astringent lotions are sufficient, with tonic treatment constitutionally. Abscess of the septum may be prevented by leeching ; when matter forms it requires evacuation. Displacement of the septum, and enlargement of bone, call for no interference.

Removal of the common polypus is effected by steady and continuous twisting in one direction, by means of small-bladed but strong, well-pointed, and toothed, slightly curved forceps ; and in using them, care should be taken to apply the forceps as closely as possible to the neck of the tumour, so as to insure removal of the entire mass ; while gentleness is used, so as to avoid, as far as possible, any unnecessary tearing of the turbinated bones. The size of the polypus can be approximately estimated, by the degree of interruption to forcible expiration through the nostril. When this is complete, the presence of a polypus occupying the posterior nares may be certainly diagnosed : and our efforts at relieving the patient should not stop at removing what can be seen of the polypus—in fact, we must persevere until he can blow freely through the nostril. In removing the polypi, when situated posteriorly, the greatest assistance may be obtained by passing two fingers of the left hand behind the soft palate upwards, to the opening of the posterior nares, so as to secure accurate seizure of the growth by the blades of the forceps before proceeding to twist it away. In other cases, when the polypous mass is large, and can be seen in the fauces projecting the soft palate before it, removal of the mass will be expedited by seizing it by means of a volsella, so as to strain upon the growth when the neck is twisted away. As the mucous polypi are generally numerous, the smaller ones may elude detection when the larger are removed, and being left behind, may then develop themselves quickly in the absence of the pressure which formerly interfered with their growth. Hence an apparent reproduction of the disease may occur, and require at the end of months, or a year, a repetition of the operation. Of this the patient may be warned, to prevent disappointment. After clearance of the nostril has been effected, the cavity may be plugged with lint ; to arrest bleeding, and prevent the access of cold air to the raw surface.

Subsequently, the use of an astringent is sometimes advisable—such as a solution of zinc, nitrate of silver, alum, matico—with a view to restore the mucous membrane to a sound state. The following injection is often found very suitable :—Sulphate of Zinc half a drachm, Tincture of Galls one drachm, Water eight ounces ; or the powder of matico, or alum mixed with sugar in fine powder, may be employed in the form of snuff.

The dense fibrous polypus always originates from the posterior part of the nasal cavity, and is developed from the periosteum clothing the basilar process of the occipital, or the body of the sphenoid, or the base of the septum. It projects backwards, is of a somewhat pyriform shape, and can be felt from the fauces. It occurs most commonly in adolescents ; and at an early period in its growth is characterised by the occurrence of repeated hemorrhage, which blanches the patient, and imperatively requires that something should be done to remove the disease. For removal of such a tumour, the ligature, consisting of cord, wire, or catgut, used to be employed. Now-a-days such growths are removed by means of powerful volsella forceps, provided with teeth, by which the mass is seized and steadied and pulled ; then the neck is detached, from or along with the periosteum, by torsion with strong polypus forceps introduced through the nares, or by means of a blunt-edged instrument resembling a narrow chisel—tearing the root from the bony surface from which it grows. The hemorrhage during the operation, in such cases, is always very copious, but generally ceases when the polypus is removed.

A dense and firm polypus may occupy the anterior part of the nares ; broad in its attachment, and firmly united with the periosteum and bone of the nasal cavity. Such tumours, according to all experience, are very prone to degenerate ; becoming vascular, softening, and ultimately assuming the medullary character. Early and complete removal, therefore, is highly expedient. The morbid structure must be taken thoroughly away, along with the parts from which it springs, and with which it is intimately incorporated. The operation may be effected by evulsion or excision, room being obtained by simple incision of the nostril. It may, however, be found necessary to remove the whole or a portion of one side of the superior maxilla, to gain sufficient access to the tumour.*

The *medullary* and malignant nasal polypi must be regarded as incurable. They are in reality medullary growths of the bone or periosteum of the nasal cavity ; by the time they come under the care of the surgeon, the morbid structure has generally extended so far as to render its entire removal impracticable ; and we can do nothing but palliate. If much distress is occasioned by occlusion of the nostril, the soft obstructing mass may from time to time be broken down by the finger or forceps ; but even this interference must be very carefully practised, lest troublesome hemorrhage ensue, or the growth be excited to more rapid development. Protrusion and pointing of the tumour, at the internal canthus, when as yet less prominently developed elsewhere, may be mistaken by an incautious observer for epiphora, or for a collection of fluid in the lachrymal sac.

The erectile tumour has been found growing from the anterior nares ;

* SYME, London and Edinburgh Monthly Journal, 1842, p. 791.

and may become dangerous by its tendency to ulcerate and bleed. Cure has been obtained by destructive application of the actual cautery, to the diseased tissue.* If this is to be employed, the galvanic cautery is certainly better suited for the purpose, than the haphazard application of the ordinary redhot iron.

Rhinolithes.

Rhinolithes, or calculi of the nasal fossæ, are composed of mucus, phosphate of lime, and the carbonates of lime and magnesia; and are most frequently found in the inferior meatus. In volume they vary from a pea to a pigeon's egg; in colour black, grey, or white; of rough surface; and often containing a foreign body, or the root of an incisor tooth, as a nucleus. Sometimes they create but little disturbance; in other cases chronic inflammatory disease is lit up; in some suppuration occurs, with profuse foetid discharge; and the septum may ultimately give way by ulceration, the whole organ becoming seriously deformed. The eye too may sympathize; and that seriously. Treatment is by extraction of the offending substance; and this is to be effected either by forceps or by scoop, as may seem most convenient; antiphlogistics being afterwards employed to subdue excitement.†

Epistaxis.

By this term is understood, an inordinate hemorrhage from one or both nostrils. It may be the immediate result of an operation for polypus; it may follow external injury, with or without fracture of the nasal bones; it may be one of the untoward results of medullary formation, within the nasal cavity, or connected with it; it may be a critical depletion, or natural occurrence—as, *e. g.*, in the course of typhus fever. It may accompany a depraved state of the general system and blood, as in scarlatinous cases, or scorbutus; or it may be the consequence of a passively congested state of the Schneiderian membrane, as in cases of disease of the heart. The common bleedings of the nose, in adolescents, caused by plethora, and tending to relieve the system from that unsafe condition, scarcely come under the designation of epistaxis; in these usually the bleeding is not inordinate, is in all respects safe and beneficial, and certainly requires the adoption of no means for its arrest.

Our first duty when called to a case of alarming hemorrhage from the nose, is not at once to attempt to check it; but to determine whether such an attempt be advisable or not. If the bleeding be habitual, in a robust and plethoric patient, not very far advanced in years—if it be at critical in its history, as connected with an inflammatory attack advancing in some adjacent part—if we are told that the patient has been subject to giddiness, or other affections of the head—we are not to interfere, unless evident signs exist that a greater amount of blood has already flowed than the system can well bear, and that further loss would pro-

* Dublin Quarterly Journal, Feb. 1847, p. 31.

† DEMARQUAY, *Annales de la Chirurgie*, July 1845; and Ranking's *Retrospect*, ii. p. 106.

bably be attended with hazardous consequences. Then—but not till then—we endeavour to prevent continuance. The patient's head is elevated; and cold is applied to the nose, forehead, and back of the neck. All stimuli are forbidden, and absolute rest and quietude enjoined. This treatment failing, astringents may be taken into the nostril, and applied to the bleeding surface, by injection—as Ruspini's styptic, a solution of zinc, alum, or perchloride of iron, or turpentine—dilute, or in the form of snuff—powdered gall nuts, tannin, matico, etc. And this method of arrest may be assisted by obstruction of the anterior nares; either by compression, or by stuffing the cavity firmly with lint, after the styptic has been sufficiently applied. Lately, it has been proposed to elevate the arm, or arms, and to retain them raised above the head; and certainly this proceeding would seem occasionally to contribute, at least, towards the successful result; perhaps in consequence of greater power being required to propel the arterial blood upwards in the arm, and less consequently being expended on the carotid circulation—as the originator of the practice,* Dr. Negrier, imagines; or perhaps in consequence of the increased facility of venous return in the subclavian vein “hurrying the return-blood in the jugulars, and thus deriving from the bleeding vessels of the nose.”

When such means fail, and the continuance of the bleeding, with the actual loss of blood, or the feeble state of the patient, demands imperatively that it shall be arrested, it is necessary to plug the nares, both anteriorly and posteriorly. A long stout ligature is passed through the nostrils into the mouth by means of a common probe, curved into a semi-circle, threaded with the cord, and passed along the nostril till it is felt in the fauces, whence it is withdrawn along with the ligature by means of dressing forceps; or, as some prefer, by a flexible bougie, or by a loop of wire or catgut, or by a springed instrument made for the express purpose, the ligature is conveyed into the mouth, and when laid hold of there, the instrument is again withdrawn through the nostril. To the middle of this ligature, a portion of sponge or a dossil of lint, about the size of the distal phalanx of the thumb, is attached—that being usually of sufficient size to occlude the posterior opening of the nares; and by pulling the nasal extremity of the ligature, the plug is firmly impacted; the extremity of the oral portion of the ligature remaining still pendent from the mouth. The anterior nostril is then filled with lint, pushed firmly from the front. After three or four days have elapsed, the apparatus is removed, gently. The anterior plug is withdrawn by means of forceps the posterior is extracted by pulling the oral extremity of the ligature—previous dislodgment, if need be, being effected by the cautious pushing of a probe passed through the nostril. Sometimes it is necessary to plug both nostrils; but, generally, the hemorrhage proceeds from one only. The posterior plug, if large enough, completely occupies the whole of the posterior nares, so that only the anterior nostril requires further plugging. Constitutional treatment should not be forgotten; more especially if there is reason to suppose that a hemorrhagic tendency exists in the system. Solution of the pernitrate of iron, in frequently repeated doses constitutes the most suitable medicine in such cases.

* Archives Generales de Medecine, June 1842.

Another method of plugging the nares has been lately proposed ; by inserting a tube of vulcanised caoutchouc, and distending this either by air or water.*

After plugging in any way, great care should be taken that all foreign matter has been thoroughly removed. Serious consequences, both local and constitutional, have resulted from a dossil of lint, or portion of sponge, having been left impacted.

When syncope has occurred from epistaxis, in an elderly patient predisposed to head affection, we should be very careful not to excite premature and excessive reaction ; otherwise extravasation within the cranium may follow. The head is not to be placed low, as in restoration from ordinary syncope, but should be kept elevated ; and stimuli should, if possible, be avoided.

The passing of Nasal Tubes.

Flexible tubes may be readily enough passed along the floor of the nostrils into the posterior fauces ; and thence they may be directed into either the larynx or the œsophagus, as circumstances may require. The former destination is necessary in attempts to restore breathing, in cases of suspended animation ; the latter, in order to introduce nutritive ingesta into the stomach—as in cut throat. If, in the latter case, the tube is to be left permanently inserted, the passage by the nose is plainly preferable to that by the mouth ; avoiding profuse salivation, and much discomfort.

In all such cases, however, the tube is very much more easily and certainly passed by the mouth ; and when lodged may, by means of a cord passed as for plugging the nares, be drawn up into the nose and withdrawn from the nostril—after which a nozzle may be applied of such size as to prevent its slipping backwards out of reach.

Foreign Bodies in the Nostrils.

Foreign bodies may lodge accidentally in the nasal cavities ; more frequently they are introduced wilfully, by the young and inconsiderate ; peas, beads, portions of pencil, and such like substances, are very commonly inserted by the thoughtless child. On the foreign body decidedly disappearing inwards, the patient is alarmed ; and probably makes desperate efforts to extrude it by the fingers, but with the effect only of pushing it further into the nostril. The parent or nurse is now made aware of the circumstance, and by them similar efforts at dislodgment are made, again with the effect of causing a deeper lodgment. By this time the foreign substance is beyond the reach of the eye ; and its site may be further obscured by the slight bleeding which may have been produced by abortive efforts at extraction. And in this condition the surgeon finds the case. Or the child may be afraid, or too young, to speak of its occurrence, and a discharge from the nostril, or symptoms of nasal irritation, may be the first indication of such a misadventure. It is well, in the first instance, when either a coagulum or discharge obstructs the view, to inject a stream of warm water into the nostril ; these it clears

* Lancet, No. 1370, p. 579 ; also Cyclop. of Pract. Surgery, p. 142.

away, and, loosening the foreign body, may effect its expulsion. If not, the nasal speculum may be employed, by which the foreign body may be seen ; or, the patient's head is firmly secured (and the best way of accomplishing this, in the child, is to place the head firmly between the knees of the operator—unless indeed anaesthesia be employed, as in most cases it should be), and then by means of the probe, used gently, we seek to ascertain the presence and site of the foreign substance—for it may have escaped from the nares, by the mouth or pharynx. Having discovered the foreign body, the flat end of the probe, slightly bent, or the scooped end of a director, or a curette made for the purpose, is passed down upon it, and insinuated past it ; then, by raising the handle of the instrument, and bringing the point to bear upon the posterior aspect of the foreign substance, the latter is dislodged forwards, and may be readily removed. Polypus forceps carefully introduced, and used as a probe till the foreign body is felt, may sometimes deal with it more surely and satisfactorily ; the operator remembering that their blades can only be opened in the perpendicular direction, and that when opened they should be passed so as to include the foreign body fairly in their grasp.

Congestion of the Schneiderian Membrane.

The lining membrane of the nostrils is liable to become the seat of a minor inflammatory process ; chronic, and unimportant as regards structural change ; but troublesome and inconvenient by its continuance. There are redundancy of secretion (often foetid), uneasy sensation, and a feeling of stuffing in the part ; not unfrequently the tone of voice is considerably impaired, and the sense of smell may also be rendered imperfect. Many of the symptoms of mucous polypus are present ; and careful exploration by the nasal speculum is necessary, to insure accuracy of diagnosis. If the affection be at all of an acute nature, a few leeches may be required more than once—applied directly to the membrane by means of a suitable glass tube ; and in the passive form of congestion, leeching may also be expedient, once, to unload the vessels of the part. Then astringents are employed ; solutions of nitrate of silver, sulphate of zinc, chloride of soda, alum, matico, etc. ; and these are patiently persevered with, either singly or combined. But in all cases an especial regard must be had to the state of the general system. Usually an atonic condition is found ; and the greatest benefit is derived from sustained exhibition of the chalybeates. In very many cases, indeed, without this tonic general treatment, all local care would prove of but little avail. Often the practitioner will find a cause for a persistent and intractable form of this affection, in a tooth projecting into the antrum, or in the presence of a dead tooth or fang of a tooth in the incisor, canine, or bicuspid region—on the removal of which the irritation of the Schneiderian membrane completely disappears. In some cases, again, it is due to a more remote cause—gastric or intestinal irritation ; and this equally requires removal.

Abscess of the Septum Narium.

Abscess may form beneath the mucous covering of the septum ; and,

when acute, the inflammatory process which causes it is usually the result of external violence. The chronic form may be independent of all apparent exciting cause, occurring in a patient of broken-down system—probably a victim of the mercurio-syphilitic taint. The bulging swelling is apt to resemble the growth of a tumour from the septum, and by its partial occlusion of the nostril simulates the symptoms of polypus. During the inflammatory period, leeches and fomentation, by means of cotton wadding soaked in warm water or oil, and inserted up the nostril, should be employed along with other suitable antiphlogistics, so as to prevent suppuration if possible. But when matter has formed, an incision should be made so as to evacuate the purulent collection.

Ulcers of the Nostrils.

1. *Simple ulceration* of the Schneiderian membrane is liable to occur from the ordinary exciting causes of ulceration of mucous tissue; exposure to cold, contact of acrid matter, irritation communicated from diseased teeth, etc. The treatment accordingly consists, first, in taking away the exciting cause—seclusion from atmospheric exposure, discontinuance of snuff-taking, removal of diseased teeth or stumps in the upper jaw; and then, according as the ulcer manifests the inflamed, irritable, or weak characters, the applications are bland and soothing, or nitrate of silver in substance or solution, or various gently stimulant lotions.

2. *Mercurio-Syphilitic ulcers* not unfrequently form in this situation; of a secondary, or, more commonly, of a tertiary character. They are obstinate, and likely to resist all mere local treatment, because they usually accompany necrosis of the nasal bones, septum, or palate. The more important remedial agents are those which affect the system; especially the iodide of potassium, and iron with cod-liver oil.

3. *Ozæna*.—By this term is understood an unhealthy ulceration of the lining membrane of the nose, with affection of the subjacent bone—rhinitis, necrosis, or both combined. Discharge is profuse, and offensive; the ulceration tends rather to spread than to heal; portions of bone from time to time come away; the nose sinks inwards, and is more or less deformed; both articulation and respiration are interfered with; and ultimately the general health may seriously give way. The nasal bones themselves may perish and exfoliate; and then the deformity is not only great but almost irremediable. The peculiarity of this ulcer is, that the ulceration is of a spreading character—simply acute, or slowly phagædænic; and that the bones are more or less extensively involved. In the adult, some attribute this affection not so much to syphilis as to the abuse of mercury. In children, the affection would seem to be connected with the strumous cachexy, or that form of it which is a manifestation of hereditary syphilis. In some instances, the discharge comes apparently from some of the sinuses of the nares; when from the antrum, the presence of a decayed tooth in the jaw, or of one lying loose in the cavity of the antrum, may occasion this copious and foetid discharge—the presence of air helping to produce the decomposition of the pus which is so offensive a feature in these cases.

Treatment is mainly constitutional; as in the simple mercurio-

syphilitic sores, without affection of bone. Besides the iodide of potassium and iron, arsenic is found a very useful internal remedy—steadily persevered with in small doses. In obstinate cases, benefit has often resulted from exhibition of the liquor hydriodatis arsenici et hydrargyri—a powerful alterative.* The local applications are necessarily varied. At first, bland and tepid injections are advisable; afterwards those which are stimulant and alterative. A weak solution of arsenic, solutions of the nitrate of silver, sulphate of zinc, etc., may be employed as circumstances seem to indicate. Throughout the cure, the chlorurets should be used, at least occasionally, as correctives of fœtor. By some, the following combination is held in high repute: an injection composed of from one to two drachms of chloruret of lime or soda, rubbed up with thirteen ounces of decoction of rhatany root—strained after standing half an hour. In scrofulous cases, ordinary antistrumous constitutional treatment will, of course, not be neglected; large doses (3 ii.) of cod-liver oil proving very useful. When the stomach is irritable, rhubarb and bicarbonate of potash, with sweet carbonate of iron, or bismuth alternated with smart cholagogues, will be found very efficacious in allaying the local irritability.

4. *Lupus*, or *Noli me tangere*, is a confirmed phagedænic ulcer; commencing usually in the upper lip, or at the exterior of the nasal cavity; spreading upwards, inwards, and around, but more in extent than in depth; often healing at one part, while it extends at another; ultimately involving the bones, denuding them, and inducing, by their destruction, hideous deformity. In advanced cases, the soft and hard parts of the nose may be wholly destroyed; while an unseemly chasm has also been made in one or both cheeks. The destructive process may advance still more extensively, producing deformities more and more hideous, and ultimately proving fatal by hectic exhaustion or pyæmia. The disease is most common in adolescents and adults—of the poorer sort, ill-fed, ill-clothed, scrofulous, or tainted in system by syphilis; and sometimes, undoubtedly, it is connected with habits of intemperance. Sometimes, however, it attacks the most carefully nurtured and temperate; as if seeming to prefer the finely-chiselled features and delicate complexions to those of coarser and rougher texture. As in other phagedænic ulcers, the affection may be either chronic or acute.

Treatment is partly constitutional—such as recommended in ozæna; partly local, consisting of such applications as are found most suitable for arrest of phagedæna. An escharotic, such as chloride of zinc, nitric acid, or nitrate of mercury, may sometimes be first employed with advantage; and then the sore is subsequently treated according to the characters which it presents. Black wash, or the greatly diluted citrine or red oxide of mercury ointment, constitute useful empirical remedies in such cases. When the sore threatens to become irritable, and verges again towards phagedæna, a weak solution of arsenic may be found to be of much service. Of escharotics, the chloride of zinc is perhaps most employed, in the form of paste; and is especially useful when bone has become affected; for it seems to hasten its exfoliation. Occasional use of the chlorurets is essential as a corrective of fœtor. Sometimes repeated

* Dublin Journal of Medical Science, September 1840, p. 98.

leeching is of advantage. After arrest and cicatrization, the greatest constitutional care is still required ; otherwise reaccession of the disease is extremely probable. In many cases, the affection, as its name imports, resists all and every kind of treatment, and pursues its course for months or years, sometimes progressively, sometimes intermittently, unaffected by all remedies. In such cases, simple protection of the surface, and a bread and milk poultice, occasionally applied, will answer better than any more decided measures.

5. *Cancerous ulcer* may implicate the nose, by extension from the face ; or may originate in the former site. It is amenable to but one treatment—early removal by knife or escharotic, or by both.

Rhinoplastics.

When the soft parts of the nose have been destroyed, partially or wholly, by wound, ulceration, or sloughing, they may be restored in some measure, by transplanting a compensating amount of cutaneous and subcutaneous tissues, borrowed from an adjoining part. When ulceration has been the destroying agent, no restorative operation is ever to be attempted, until satisfactory evidence have been afforded that all ulceration has ceased, and is not very likely to return on the application of a common exciting cause of the inflammatory process. Under any circumstances, it is plain that the sequela of lupus presents a much less favourable prognosis, than when the cicatrix is the result of wound, or any other simple casualty.

When almost the entire organ has been removed, its restoration may be effected in different ways, of which the best are as follows* :—Two

flaps of skin, of the annexed form, having been marked out on the cheeks, are to be dissected up from the surface of the maxillary bones. The margins A B and A C, are then to be brought together by three or four points of silver wire suture ; and the outer edges of the flaps, as far as E and D, are to be attached to the raw surface at a suitable distance from the nasal aperture.

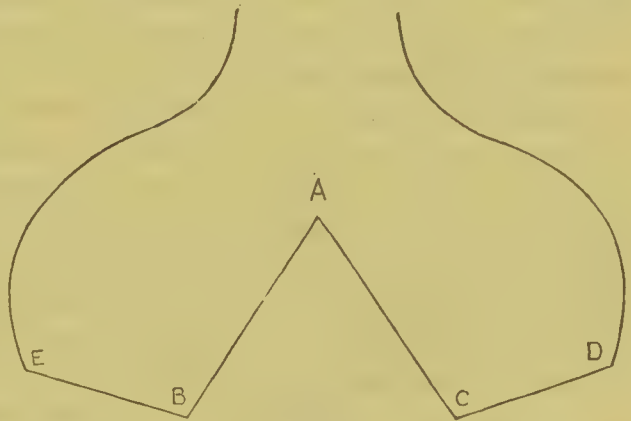


Fig. 267.

The gaping wounds in the cheeks will now be readily approximated at their outer angles by points of suture, while the rest of the surface heals by granulation ; the cicatricial depression so produced tending only to add to the effect of the nasal prominence. The cavity of the new nose should be supported with lint, with compresses applied externally on each side of the new feature, which may be retained in position by the application of the blades of a small pair of dissecting forceps astride the organ longitudinally.

When, however, the cheeks have been destroyed by the same ulcera-

* See Syme's Observations in Clinical Surgery, 2d edition, p. 58.

tive process that has rendered the restoration of the nose necessary, the new structure may be made from the integument of the forehead. The size of the nose should be planned by means of a piece of paper, cut of a triangular form ; but in shaping it due allowance must be made in the calculation for the shrinking of the flap when dissected up, and the after shrivelling, by absorption, which will continue for months after the operation. The base of the triangular flap may be left either plain, or with a projecting central tongue which shall constitute the *columna nasi*. The outline of the triangular flap is then laid flat on the forehead ; the base pointing upwards, the neck resting between the eyebrows. It is there steadily held, while the surgeon, with ink, or at once with the knife's point, maps out its boundaries. Thus defined, the flap, consisting of all but the pericranium, is carefully dissected down. The neck of the flap is made sufficiently long to admit of its being turned round to occupy the site of the nose, without serious interruption to the circulation ; and, to facilitate this movement, the incision should be carried lower down on that side to which the twist is to be made. The edges of the nasal opening, to which the margins of the flap are to be attached—and the centre of the upper lip, if a *columna* has been included in the formation of the flap—should now be removed completely, so as to provide a raw surface for adhesion with the flap. The oozing of blood having ceased, the flap is brought round and adjusted carefully and accurately, by the requisite number of points of interrupted suture ; and by the introduction of dossils of lint into the nostrils, the necessary support is afforded to the new nose. The lower part of the wound in the forehead is brought together by suture, and may unite by the first intention ; the rest is covered with water-dressing, and left to granulate. The flap adheres along its margins by adhesion ; the rest of the raw surface, which is unattached, by granulation ; the stitches are removed as late as possible ; the interior stuffing is changed from time to time, and may be medicated if necessary. Ultimately—in twelve or fourteen days, usually—the borrowed substance becomes firmly fixed in its new position. After the lapse of a month or six weeks, when the parts have consolidated, and the nutrition of the nose is maintained quite as much by its lateral attachments as by its neck, this latter twisted and unseemly connecting link with its old position may be dealt with. If the *ossa nasi* have been left entire, with their integument, the apex and *alæ* only having been destroyed, it may be divided and turned back to its old site. A wedge-shaped portion is then taken away by means of a bistoury ; and adjustment is effected by the help of a little dissection of the integument around it. But if the *ossa nasi* have been lost, it is well to leave the medium of attachment uninterfered with ; only securing its incorporation with the subjacent surface ; for by its continued presence, the want of prominence which the loss of the nasal bones could not fail otherwise to produce will be very much compensated. Besides, continued nutrition of the transplanted flap will be fully secured, and its shrivelling by atrophy may be in a great measure prevented. If the prominence should threaten to be excessive, it may be reduced by compression suitably applied. If the *columna* has been formed at the same time as the nose, sponge tents or tubes will be required

to prevent circular contraction of the nostrils so formed from occluding the apertures.

Certain precautions are always to be attended to in such rhinoplastic proceedings. As already stated, the flap should at first seem far too large; if neatly fitting at the time, it is sure to prove insufficient afterwards. Twisting is effected very gently and carefully, lest strangulation ensue; and to prevent this as much as possible, some advise that the flap should be dissected from the supra-orbital region, and not from the centre of the forehead, as thus less displacement will be required from its normal direction. Should engorgement occur, relief is to be obtained for the passively congested vessels, by punctures, or by drawing blood from the still raw edges. Erysipelas may supervene; if it does, the transplanted part need not be exempted from puncture or incision, if

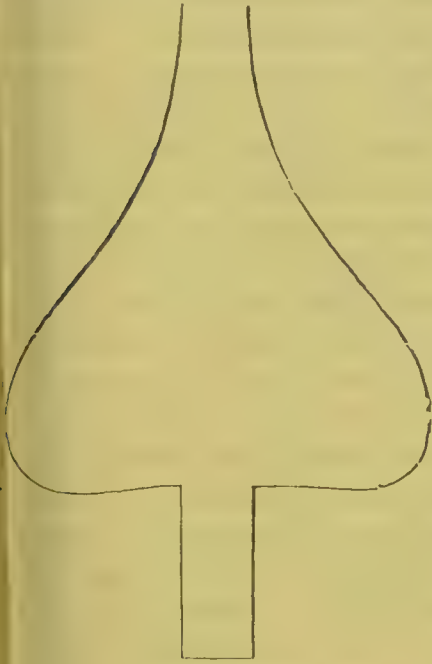


Fig. 268.

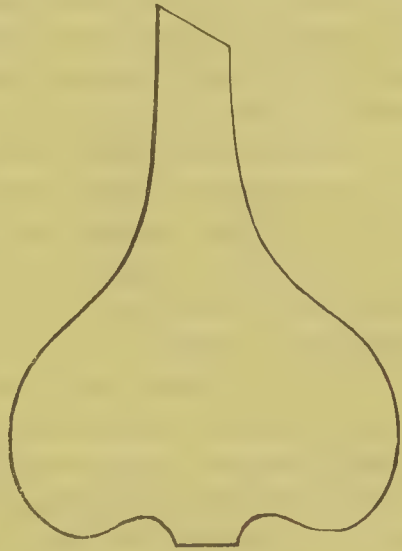


Fig. 269.

these be deemed necessary; for experience declares it to possess at least an equal tolerance of such remedial treatment as the original textures.

When peculiar circumstances render the ordinary operation impracticable, the flap may be taken from the hairy scalp, as practised by Dieffenbach; the hair having been previously removed by means of the chloride of mercury in solution; and the flap being connected with a narrow strip of the integuments of the forehead.

When consolidation of the new alæ and apex has been duly effected, and the columna has not been formed along with the nose, it may be made according to the method first proposed by Mr. Liston.* This method was preferred by him because in most cases the centre of the

* Practical Surgery, p. 253.

Fig. 268. Plan of flap for a new nose, according to the original Indian method; columna, apex, and alæ being all made at once. About one-half the natural size.

Fig. 269. Plan of flap for new nose, as modified by Mr. Liston. The apex and alæ provided for; the columna to be brought, subsequently, from the upper lip. About one-half the natural size.

upper lip is found tumid and elongated ; and, consequently, removal of a portion of the redundancy would of itself be a considerable improvement.

"The inner surface of the apex is first pared. A sharp-pointed bistoury is then passed through the upper lip—previously stretched and raised by an assistant—close to the ruins of the former columna, and about an eighth of an inch on one side of the mesial line. The incision is continued down, in a straight direction, to the free margin of the lip ; and a similar one, parallel to the former, is made on the opposite side of the mesial line, so as to insulate a flap about a quarter of an inch in breadth, and composed of skin, mucous membrane, and interposed substance. The frænulum is then divided, and the prolabium of the flap removed. In order to fix the new columna firmly and with accuracy in its proper place, a sewing needle—its head being covered with sealing-wax to facilitate its introduction—is passed from without through the apex of the nose, and obliquely through the extremity of the elevated flap : a few turns of thread over this suffice to approximate and retain the surfaces. The flap is not twisted round as in the operation already detailed, but simply elevated, so as to do away with the risk of failure. Twisting is here unnecessary ; for the mucous lining of the lip, forming the outer surface of the columna, readily assumes the colour and appearance of integument, after exposure for some time, as is well known." The fixing of the columna having been accomplished, the edges of the lip must be neatly brought together by the twisted suture, or silver wire suture, as in hare-lip, after the edges have been raised. "Some care is afterwards required, from both surgeon and patient, in raising up the alæ, by filling them with lint—thus compressing the columna, so as to diminish the cedematous swelling which takes place in it, to a greater or less degree, and repressing the granulations. It is, besides, necessary to push upwards the lower part of the column, so that it may come into its proper situation ; and this is done by the application of a small round roll of linen, supported by a narrow bandage passed over it and secured behind the vertex."

Partial Restoration of the Nose.

When a portion of either ala is destroyed, the deficiency may be readily supplied from the adjoining cheek ; if there be the ordinary fullness there. The flap is raised, transplanted, and has its vascular supply maintained, by conducting the operation in the same way as for restoration of the whole organ. The wound in the cheek may, generally, be approximated entirely ; and, in consequence, may be expected to unite by the first intention.

The entire ala may be restored in a similar way. But if the cheek be either naturally spare, or already occupied by cicatrices, the flap must be brought from the forehead. An operation is performed, similar to that for restoration of the whole organ, but on a minor scale. When the ridge of the nose is long, it is well to make a suitable furrow in its centre—by incision—for reception of the long connecting slip ; which, otherwise, finding itself but indifferently supported on the exterior of the nasal integument, might fail to afford due nourishment to the flap,

and induce its sphacelation. After union has occurred throughout the whole wound, the connecting slip may be raised from its temporary bed, and the raw edges of its site approximated; or it may be left undisturbed; according as circumstances may seem to indicate.

Loss of the apex and both alæ is supplied by a frontal flap; with or without lodgment of the connecting slip, according to the length of the nasal ridge.

The ridge itself, when deficient, may be restored by a frontal flap, very readily and efficiently; either by adapting a suitable portion to its surface, made raw; or by inserting a slip into a sulcus made for its re-



Fig. 270.

ception. By cutting out the depressed portion, and approximating the margins of the wound by suture, depression may be removed, in some cases satisfactorily; but, in most, such an attempt would be followed by an elevation of the apex, causing a deformity little less unseemly than the original one.

When the columna alone is deficient, the operation for its restoration is performed, as detailed at page 750.

Not unfrequently, the columna and the integumental part of the alæ and apex remain entire, while the cartilaginous texture has suffered more or less dilapidation; and the nose, in consequence, shrinks, falls upwards, and is much deformed. Autoplasty is not required to remedy this case. In some examples it is sufficient to divide carefully the abnormal adhesions within, to elevate the nostrils then to their normal level, and to maintain this elevation subsequently by suitable stuffing of the cavities. In other cases, however, such manipulation is found insufficient; and then it is expedient to approximate the cheeks, so as to force the nose into increased prominency; the original insertions of the alæ on the cheek having been previously detached, by subcutaneous incision, or by dividing the remains of the organ by an incision on both

Fig. 270. "The alæ of the nose, deficiencies in the upper, anterior, or lateral parts of the organ, in the forehead, etc., may be supplied from the neighbouring integument, on the same principle as the preceding repairs. In many of these operations the flap can be so contrived and cut out, as that it can be applied without its attachment being twisted. The form of such flaps is here given."—LISTON.

sides of the septum of the nose, so as to admit of free dissection being effected. The organ, thus rendered movable, is transfixed at its base horizontally, by soft iron needles, which are made to perforate a piece of leather, or wood, after emerging from the nose; and by twisting the extremities of the needles, on this exterior foreign substance, the due amount of approximation is effected and maintained.*

When there is both depression of the *alæ* and apex and loss of the *columna*, the depression is first to be removed; and then a new *columna* is to be constructed in the way already described.

But, in truth, no exact details can be established for any autoplasmic or simply restorative operation on this organ; the proceedings must vary, in almost every case, according to its peculiar circumstances.

It is right further to state, that the majority of such operations come under the category of those of "complaisance"—undertaken under no absolute necessity, but rather to please the patient—proverbially prone to untoward casualties in the after-treatment. The flap may shrink or slough; ulceration may recur; erysipelas, phlebitis, pyæmia, may peril existence. And, at the same time, it is to be remembered that a very good substitute for the lost organ may be adapted by the mechanic, without pain or danger.

* Fergusson's Practical Surgery, p. 454; also Association Journal, Feb. 18, 1853, p. 154.

CHAPTER XXXV.

AFFECTIONS OF THE SUPERIOR MAXILLA.

Collection of Fluid in the Antrum.

THE antrum is liable to become the seat of a chronic collection of fluid, whereby its parietes are expanded and attenuated, and its cavity much enlarged. The condition is ordinarily termed abscess ; but it seems very doubtful if this appellation be accurately applied. The fluid may be puriform, but is seldom purulent. It is more like what is usually found in serous cysts ; sometimes thin and serous, sometimes glairy, sometimes sanguinolent, sometimes puriform, not unfrequently mingled with more or less of solid curdy matter. Sometimes a permanent tooth (canine) is found loose in the cavity. The parietes of the cavity are not thickened by fresh osseous formation, as in chronic abscess ; on the contrary, they are simply expanded, becoming thin, and in some places perhaps deficient—the loss being supplied by membranous structure, contributed probably by the periosteum. In short, the morbid condition more resembles that of osteocystoma, than that of chronic abscess of bone.

The symptoms of the affection are—the existence of but slight heaviness in the part throughout its slow progress ; rounded swelling of the cheek, through which the thin osseous shell may be felt to rattle on pressure ; fluctuation can be detected where the prominence is greatest, if the parietes have become much attenuated ; the palate may bulge considerably downwards ; there is sometimes increased secretion from the corresponding nostril, which may consist merely of mucus or of the fluid which escapes from the cavity of the antrum by its communication with the nostril ; and, from the hanging and stiffness of the lip on that side, articulation may be interfered with. The change may be attributed to a slight and remote injury ; or to the presence of decayed teeth in the corresponding maxilla ; but, very frequently, there is no assignable exciting cause—unless frequent attacks of coryza, or a tendency to congestive affections of the Schneiderian membrane, can be looked on as such.

The treatment consists in evacuation ; and the opening must be free and dependent. An aperture sufficiently dependent may be formed in the corresponding alveoli of the canine or first molar teeth ; and sometimes a communication is found already established there, on removal of the decayed teeth or stumps. But such an opening is seldom if ever sufficiently free, when of spontaneous formation ; indeed, sufficient space is not readily obtained at this part, even by operation. And it is essential that the opening shall be of some considerable size ; otherwise the

fluid will not escape by it ; but will be retained by atmospheric pressure—as in the case of the narrow-necked bottle, which when filled with water is suspended in an inverted position for barometric purposes. It is better to make an opening through the most dependent part of the attenuated parietes, above the first molars. The membrane of the cheek is incised there ; and, by means of the same instrument—a strong bistoury—the parietes of the cavity may also be perforated in the greater number of cases. If the bone, however, prove thick and resisting, a pointed lever, as used for the extraction of decayed teeth, may be employed. Should the bone resist the enlargement of this aperture, the blade of the cutting pliers, or a small trephine, may be employed. An aperture having been made, in one way or other, of dimensions to admit the point of the finger, through this the contents readily drain away. Thus, also, re-accumulation is effectually prevented ; and, by pressure from without, return to the normal state by contraction is favoured. It is sometimes advisable to apply tincture of iodine by means of a hair pencil to the membrane lining the cavity, so as to correct its tendency to hyper-secretion.

Abscess of the Antrum.

The lining membrane may undergo the inflammatory process, with or without the application of external violence ; and suppuration may ensue. The affection may be either chronic or acute. In the former event, the case will very much resemble the cystic enlargement just detailed. This, however, is of rare occurrence, and is usually unconnected with external injury.

Acute abscess generally results from violence applied, or from irritation communicated by decayed teeth or other affections of the gums. The symptoms are severe. With a considerable amount of constitutional disturbance, there are deep-seated and great pain, tension and throbbing, and swelling of the superimposed soft parts. Usually partial

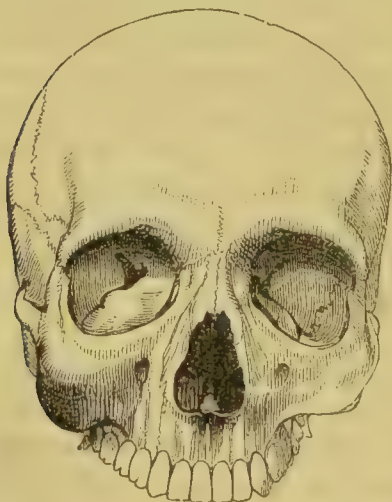


Fig. 271.

evacuation takes place, spontaneously by the side of a tooth or through the naso-antral aperture ; with relief from the more prominent symptoms. Such imperfect evacuation and relief, however, are not enough ; the operation above the bicuspid teeth, as for emptying the indolent fluid collection, must be had recourse to. But, of course, in the first instance, attempts are made to forego the necessity of all operative interference, by timeously arresting the inflammatory process, if possible, ere matter has at all formed. When purulent accumulation has taken place, the

artificial opening cannot be too soon established. For from the turgid state of the membrane, it is very obvious that no effectual relief can be

Fig. 271. Enlargement of the antrum, by accumulation of fluid within.

expected from spontaneous evacuation through the nasal aperture—as sometimes happens in the indolent collection of fluid.

Polypus of the Antrum.

The lining membrane of this cavity, like that of the nostrils, may give origin to polypous formations. The occurrence of mucous polypi here, however, is unknown. The fibrous polypus of the nostrils sometimes makes its way into the antrum, and developing itself in this situation produces absorption of the anterior and external wall of the cavity. Here it may be felt through the mucous membrane of the mouth, and has generally a rounded form, and possesses a doughy consistency on manipulation. The medullary formation is not uncommon; constituting the origin of osteocephaloma, as affecting this bone.

If indications exist of the presence of a fibrous polypus within the antrum, it should be attacked by an incision through the mucous membrane, so as to expose the cavity from the mouth; without division of the lip. The eradication of the morbid growth must be effected by seizing and drawing firmly upon the tumour by means of strong volsella forceps; while, by means of instruments introduced through the nose, the origin should be simultaneously detached from that portion of the nasal fossa from which it grows. Such cases, however, are rare.

Tumours of the Superior Maxilla.

Two forms of tumour are liable to occur in this bone; Osteosarcoma and Osteocephaloma. Tumours very different in themselves, and requiring very different treatment; the one capable of removal, at an advanced age, and after a large or even enormous size has been attained: the other not admitting of operative interference unless seen at an early period of its development, and before it has extended beyond the limits of the upper maxilla.

The osteosarcoma may reach a large size by external bulging, and by expansion of the bone; but, unless it degenerate in structure, though it may produce absorption of the osseous structures upon which it presses, it remains limited within the confines of the superior maxilla; and consequently, by removal of that bone alone, the whole of the diseased situation may be taken away. The swelling projects into the fauces, into the mouth, and outwards on the cheek; the main protuberance is in the last named direction, interfering with articulation, mastication, and vision; and the general health may be hale in all respects. When perforation of the mucous membrane covering the tumour occurs, a thin serous discharge escapes by the mouth, seldom bloody, and seldom offensive.

The remedy is excision of the superior maxilla; and this, though a severe and somewhat difficult operation, may be fearlessly undertaken, even in the most advanced cases of this disease—if genuine; experience having proved that the issue of such operations is almost invariably satisfactory. Such growths usually commence during adolescence from the alveolar aspect of the maxilla, and extend upwards, occupying the antrum, and latterly invading the orbital plate of the bone and its malar

attachment. In operating, then, in these cases, it is sometimes possible to effect complete removal of the disease, leaving intact the orbital plate and malar process; and when this is possible, the result, as far as appearance goes, is infinitely better than when the whole bone has been removed. In some cases, however, the tumour is developed in connection with the periosteum of the maxilla, and grows simultaneously from every surface of the bone, and within the antrum.

The osteocephaloma is in most cases of malignant nature from the first, and has extended beyond the limits of the superior maxilla before any considerable prominence has appeared externally. The tumour towards the cheek may be yet trifling, while the mouth and fauces are completely occupied, and the base of the cranium hopelessly involved. The system, too, is early affected by the malignant cachexia. In such cases, we cannot—by excision of the superior maxilla, the palatine bones, and the malar—hope to take away the whole of the tumour; a portion remains, deep-seated and inaccessible; should the patient not die from the shock and loss of blood during the operation, reproduction of the tumour occurs, with a soft, fungated, and bleeding mass occupying the mouth; and the fatal result is in such cases only precipitated by interference. In short, while we may perform excision of the upper jaw with the best prospect of success, at any period of the case, in osteosarcoma; we ought to refrain from operation in all examples of osteocephaloma, excepting those in which we are satisfied that the disease is only commencing, and, as yet, limited to the bone in which it began. Such cases are, however, very rare. Any enlargement of the root of the nose, or obstruction of the nostril on the affected side especially if it has appeared at an early stage of the disease, and has been accompanied by the appearance of a vascular polypus in the cavity attended with repeated attacks of hemorrhage, or where the eyeball is protruded by a tumour with extensive attachments and of soft elastic consistency, should be considered as insuperable obstacles to the successful performance of the operation. In any case of doubt, the extent of the disease, posteriorly, should be carefully examined by the finger carried upwards behind the soft palate, so as to estimate the condition of the sphenoid and temporal bones.

Extirpation of the Superior Maxilla.

The patient, before the days of chloroform, was seated firmly on a chair, but when chloroform is given, should recline on a table with the head and shoulders elevated so as to facilitate the manipulations of the surgeon, and so turned as to favour the outward escape of blood. Every care must be taken to prevent the main risk, namely, asphyxia by accumulation of blood in the air passages.

The tooth or teeth having been extracted at the point where section of the alveolar process is intended to be made, the incision by which access is gained to the tumour may either be carried from the inner corner of the eye, over the nasal process of the superior maxilla, down the free margin of the upper lip, or to the angle of the mouth; or the lip may be divided in the mesial line, and the incision carried into the

nostril by detaching the ala. Should the tumour be of large size towards the cheek, the incision will require to be extended from the external angular process of the frontal bone, or malar prominence, obliquely downwards to the angle of the mouth; dividing the whole thickness of the cheek. The flap, indicated by either of these two lines of incision, is then dissected off the tumour; and is held out of the way by an assistant. The orbital fascia is divided along the lower margin of the orbit, and the contents having been separated from the orbital plate, may be gently elevated and protected by a flat copper spatula, which is also held by the assistant. By a small saw—stronger and longer than what is ordinarily sold as Hey's—the union between the maxillary and malar bone is severed. By the same instrument the nasal attachment is divided, and then the alveolar process is cut through, at the point where the tooth has been extracted; and a groove may also be made in the palatal plate



Fig. 272.

this is deemed necessary. A pair of powerful bone-pliers are then used to complete the section of the osseous attachments already mentioned. If such an instrument be not at hand, however, the section may be completed readily enough by means of the saw alone. But in most cases the bone is so easily divided by the cutting pliers, that, except for the malar bone, the saw is unnecessary. Now, by pressing the tumour downwards, and tilting it outwards, the bone-pliers being employed as a lever, and the healthy alveolar process acting as a fulcrum, it is disengaged from its connections. At this period of the operation the soft palate should be divided transversely, from the point of the hamular process of the palate bone, or from the tuberosity of the alveolar process of the maxilla, to the middle line, and the bone will then be easily moved from its bed by further depressing the tumour, and twisting it from side to side—due care being taken of the eyeball meanwhile. Should the tumour, however, be too small to afford sufficient purchase, then pressure from above with the thumbs upon the margin of the orbit will generally suffice to effect the dislodgment. If the

Fig. 272. Tumour of the upper jaw; shewing the lines of incision for removal.

“lion” or “gripe” forceps are at hand, they command the maxilla more thoroughly, so as to enable the operator with the slightest effort to remove the bone; while complete separation may be assisted by cutting with the knife or scissors those soft parts which require division; the finger, however, usually suffices for this purpose. Sometimes the palate bone comes away with the maxilla, sometimes it remains and is of service afterwards when a false palate and teeth are fitted in. One or two vessels, branches of the internal maxillary, hanging in the deep wound, will probably require ligature; and the facial vessels, which during the operation, if not tied at once, were restrained by the fingers of an assistant, are also secured. The amount of deep bleeding in non-malignant cases is generally trivial—the vessels being torn, not cut, during evulsion of the tumour—and certainly never requires ligature of the



Fig. 273.

carotid as a preliminary proceeding. The vacant space, having been cleared of coagulum, is filled with lint; and over this the flap is laid down. The incision is then brought together with great accuracy, by means of the wire suture, and one harelip suture may be employed with advantage at the labial margin. Union by adhesion generally occurs in almost the entire extent of the facial wound. The deep cavity of course suppurates. The lint loosens, and is brought away. A less amount of dressing is daily renewed, medicated with a weak solution of the chlorurets; and cicatrization is obtained in due time. In some cases, a marked deficiency remains; and this may be remedied by the skill of the dentist. But in other cases, the deficiency is wonderfully atoned for; partly by the formation of new matter, partly by contraction and accommodation of the old. If after-bleeding ensue, removal of the lint which acts as a poultice to the part, soaked as it now

Fig. 273. Portrait after removal of the upper jaw, for osteosarcoma. An example of how little deformity may in some cases remain.

must be with blood and saliva, will usually be followed by a complete spontaneous arrest. Should any arterial branch be seen, it should be tied; but persistent general oozing will either cease spontaneously, or be checked by rinsing the mouth with cold water, or with a weak solution of perchloride of iron or matricaria.

When the tumour is of large size, and the malar bone is encroached upon, this must be taken away along with the maxilla. In such a case, a further incision, along the zygoma, may be necessary to enable us to reach the confines of the tumour.

If the tumour be small, one very limited incision from the nostril to the free margin of the lip will usually suffice; it being quite possible to expose the parts sufficiently, by raising the lip, dividing the attachment of the ala of the nose, and dissecting up the cheek, while the skin of the face is retained entire. When the orbital plate is not involved, the malar and nasal processes are left intact, and the saw is carried transversely across the bone from below the malar prominence till it cuts into the nostril; then the alveolar process, hard and soft palate, and the muscular attachments of the maxillary tuberosity, only require division to effect the complete removal of the portion of bone engaged in the disease. Sometimes a portion of the tumour which the saw has cut through will be found in the upper part of the cavity of the antrum which remains; this, if the tumour is non-malignant, will be found loose and can be removed by the fingers. If, however, the tumour is of doubtful character, and the bone which remains has any indication of implication in the disease, this should determine the complete extirpation of what remains of the maxillary bone on that side.

In no circumstance can there be any propriety in resorting to the clumsy operations which were performed by our forefathers in such cases;—commencing our operation by attacking the centre of the tumour, and endeavouring to limit our removal of parts by scooping out the diseased texture by means of a gouge or similar instrument. The principle on which the operation is to be undertaken is to go beyond the disease, and to cut through sound osseous tissue; grubbing at such tumours only secures their extension, while their complete removal gives a permanently satisfactory result. No doubt, should the surgeon be uncertain as to the solidity of the enlargement, an exploratory puncture should be made in the direction of the antrum, previous to operation. For, excision of the upper jaw is not required in the case of mere distension of the antrum by accumulation of fluid. Or should we be in doubt whether it is a tumour of the maxilla, or a polypus of the antrum, then exploration of the tumour through an incision made down upon it should be resorted to before proceeding to extirpate the bone. In cases, however, of fibrous polypus of the posterior nares, excision of a portion of the jaw may be required as a preliminary measure, to enable the surgeon to reach the growth so as to effect its removal. In making a selection of the line of incision to be preferred, it must be borne in mind that those which involve the middle of the face are less obvious afterwards than the incision from the malar bone to the angle of the mouth; partly because the cicatrix produces less deformity in this situation, partly because we avoid the division of the branches of the portio dura, which must be cut when the incision passes obliquely through the cheek.

CHAPTER XXXVI.

AFFECTIONS OF THE FACE.

Wounds.

WOUNDS of the face bleed freely, and usually require deligation or torsion of the vessels implicated. Coaptation should be carefully effected, as union by adhesion usually occurs, little cicatricial deformity resulting. When the wound does not penetrate through the cheek, but is above the level of the teeth of the lower jaw, the communication with the buccal cavity should be made complete, so as to secure a free escape of blood, etc., into the mouth, and thus promote accurate and immediate union of the superficial incision. Perpendicular wounds may open into the parotid duct, or completely divide it, giving rise to one form of salivary fistula. In such wounds, division of the branches of the portio dura, with paralysis of the cheek, at least for a time, can hardly fail to occur. After cicatrization, resumption of the nervous function may be expedited by friction.

Warts.

Warts not unfrequently form on the integument of the face. They should not be allowed to remain: for, by the time old age has supervened, they will be found either already degenerated, or prone to become so. It is well to remove them early, while they are yet simple, by an elliptical incision including the portion of skin from which they grow.

Erysipelas.

Erysipelas seldom assumes the phlegmonous form in the face. Punctures, consequently, suffice for abstraction of blood, and relief of tension. They may be made freely; for the cicatrices leave no unseemly trace. But with the chalybeate treatment these are rarely required. Dusting the surface with flour, or painting it with glycerine and oxide of zinc, sufficing to allay the burning pain. After disappearance of the main attack, the patient must be carefully watched for some days; reaccession with secondary abscess, being very apt to occur in the areolar tissue of the lower eyelids.

Boils and Anthrax.

Boils and carbuncles occur frequently upon the face; the former in adolescents, the latter in elderly patients. They require the same treatment as elsewhere. In young females, incision should always be avoided.

if possible, as, if any scar results, the surgeon is sure to be blamed for the disfigurement. Irritation of the sebaceous follicles, and too free an indulgence in fatty articles of diet, apparently predispose to their formation.

Spasm.

Spasmodic twitching of the muscles on one side of the face—the *orbicularis palpebrarum*, the levators and retractors of the upper lip, and the corresponding muscles of the nose—is an unpleasant affection of no uncommon occurrence. Often it will yield to general treatment; more especially to regulation of the *primæ viæ*. Sometimes, also, patient counter-irritation is of use, directly over the part; and probably the preferable mode of applying this, is by rubbing on nitrate of silver in substance, so as to vesicate. In chronic and obstinate cases, tenotomy has been had recourse to.* In one example, permanent cure followed subcutaneous division of the *zygomatici*, the *levator anguli oris*, a portion of the *orbicularis palpebrarum*, and the *depressor alæ nasi*. In order to restrain hemorrhage, and consequent ecchymosis, likely to result from such a cross wound of the face, accurate pressure is necessary immediately after withdrawal of the knife. In many instances, however, the affection is due to mental influences disturbing the nervous balance which directs the muscles of expression, and is quite as little under remedial control as blushing. In such cases division of the muscles could only make matters worse.

Neuralgia.

Neuralgia affecting the branches of the fifth pair of nerves is termed *Tic Douloureux*; at once, unfortunately, one of the most distressing and most unmanageable affections to which the human frame is liable. The treatment is supposed to fall within the peculiar province of the physician; and consists in carrying out the general principles on which the management of neuralgia is ordinarily conducted. At one time the surgeon's aid was not unfrequently sought; division of the trunk of the affected nerve being supposed likely to afford at least an alleviation of the distressing symptoms. Experience has proved, however, that such an operation is in most cases inexpedient; the relief, if any, is but partial and temporary; and the neuromatous enlargements, which form on the truncated extremities of the nerve, are likely to produce ultimate aggravation. The operation, in truth, may be the means of converting an example of neuralgia, unconnected with structural change, in any part of the nerve, into a worse form, dependent on structural change, not only considerable, but probably irremediable. Sometimes the operation has proved successful upon one nerve, only to drive the neuralgia to another—perhaps inaccessible. Very seldom does it effect a complete cure. In all fortunate examples the cause of the neuralgia must have lain in the peripheral distribution of the nerve beyond its emergence from its osseous canal, or where formation of osseous matter around the orifice of the canal has admitted of removal at the same time that the nerve has been divided.

* DIEFFENBACH on Division of Tendons and Muscles, Berlin, 1841, p. 315.

Tumours of the Cheek.

Tumours form in front of the ear, and are of various kinds. They may be simple, fatty, fibrous, or cystic. Calcareous formations, too, are not unfrequent; the earthy matter being deposited in the stroma of an enlarged lymphatic gland. In removing such growths by the knife, the greatest caution should guide the movements of the hand; lest the branches of the *portio dura* be cut across, and paralysis of the cheek ensue; and lest by division of the parotid duct, salivary fistula be established. In order to meet such indications, the dissection should be proceeded with in the direction of the endangered parts—horizontally; contravening the general rule of cutting in the direction of subjacent muscular fibre.

Abscess of the Parotid Region.

This may either be superficial, connected with inflammatory affection of the lymphatics in this region, or deeply seated within the parotid fascia; from the density of structure, the formation of pus is attended with great tension, pain, and febrile irritation. Such suppurations may follow the crisis of fever, may depend upon the inflammatory change of the parotid gland accompanying salivation, or be due to disease of the temporal bone, neck of the jaw, or temporo-maxillary articulation. In such cases, if left to themselves, the pus collecting deeply may effect its escape by the meatus auditorius externus, by the pharynx, or at the side of the root of the tongue. Whenever the limited induration of the parotid region is accompanied by redness of the surface, oedema of surrounding parts, and rigors, incision should be no longer delayed; and the opening should extend deeply enough to open the external wall of the parotid fascia. An incision between the angle of the jaw and the point of the mastoid process will effect this safely, its depth being regulated by the amount of swelling.

Tumours in the Parotid Region.

Tumours consisting of morbid degenerations of the parotid gland are fortunately rare. For this gland is so situated as to render the entire extirpation of it, even in the healthy state, an impossible operation. Those cases which abound in the older works and cases of surgical writers, in which extirpation of this gland was supposed to have been effected, modern experience has proved to have consisted of fibrous or fibro-cystic growths forming within the gland, or within the parotid fascia, and which in their gradual enlargement have produced atrophy of the gland, so as to occupy its place, and become moulded to its form, dipping in some cases even behind the neck of the jaw into the pterygoid fossa. However large, if the simple character of the growth has been well ascertained by attention to its physical characters and history, an operation may be undertaken with the certainty of success. The incisions should be made at a point where the tumour is most prominent, and a crucial wound usually affords most room for a careful dissection, the edge of the knife being carried in successive strokes upon the surface of the tumour

so as to avoid injury to the *portio dura* nerve and the temporo-maxillary artery, which lie respectively to its anterior and inner aspects. Malignant formations, however, unless superficial, should uniformly be let alone; for in their case reproduction is certain, if any portion of the original growth, however slight, be permitted to remain; and the extensive connection of the lymphatics in this region always excites suspicions of some deeper seated malignant disease. Enlargement of a single lymphatic gland in this situation may simulate a tumour; but its individual characters, its antecedents, and its accompaniments, will usually indicate sufficiently its nature and treatment.

Sinus of the Cheek.

Patients frequently present themselves under the following circumstances. They are adolescents, or recently adult; and are more frequently female than male. Many months previously, an abscess formed on the lower part of the cheek, over or beneath the body of the lower jaw; evacuation took place; a more or less copious discharge has continued ever since; and though many and various remedial means have been employed, cicatrization, or even marked amendment, has never been obtained. There is a weak sinuous ulcer, with a pouting external surface; and the surrounding integuments are swollen and discoloured by passive congestion; or, if the discharge is small in quantity, there is a puckered and retracted attempt at a cicatrix. In the great majority of such cases, if not in all, the exciting and retaining cause is to be found within the mouth. Opposite, or nearly opposite, the affection of the cheek, a decayed tooth or stump, or a discoloured tooth with a dead fang, will be found, probably imbedded in a diseased gum. And on removal of these sources of irritation—and not until then—will the sinus and ulcer be brought to heal. Without extraction of the offending tooth or teeth, the most energetic and sustained practice may be put in force against the cheek, without success. After extraction, healing may occur even without any remedial means having been applied directly to the part.

Salivary Fistula.

In consequence of wound, abscess, or ulceration, the duct of the parotid gland may open externally on the cheek. And by outward discharge through the fistulous aperture, not only are deformity and inconvenience occasioned, but also a serious loss is sustained of secretion valuable in the processes of mastication and digestion. The principles on which a cure is to be attempted are very simple; namely, the establishment of an internal opening, by which the saliva may be poured into the mouth, and saved; and the shutting up of the external aperture whence this fluid has previously run to waste. To effect this in practice is, however, no easy matter. Dilatation of the duct between the fistulous opening and the papillary aperture of the duct, opposite the second molar in the upper jaw, may sometimes suffice to effect the first of these indications. In doing this, a foreign body, such as a barley corn, a bit of fish-bone, or the hair of a tooth-brush, may perhaps be detected lying in the

duct ; acting as a foreign body, occluding the buccal extremity of the canal, and determining the apparently idiopathic suppuration of the cheek, which, in the first instance, gave rise to the fistula. Should mere dilatation not suffice, then a straight needle, carrying a silver wire, should be passed from the external opening of the fistula into the mouth as far back as possible ; the wire is then drawn forwards, and retained in the mouth ; the needle is now threaded with the other end of the wire, which is passed in at the same external opening, and made to penetrate the mucous membrane at about the distance of half an inch from the first puncture ; the two ends of the wire are then twisted together, and day by day the twisting is continued, till the triangular portion, included in the loop of wire, is cut through. Should the external aperture not spontaneously heal during this process, its cicatricial margins may be removed by an elliptical incision, the surfaces of which are to be brought into accurate contact by means of a point of twisted suture. If the fistulous aperture is very small, contraction may be induced by the application of a red-hot wire, at long intervals. Autoplasty may be of use, in those cases in which there is much loss of substance, and in which the ordinary means of effecting closure have failed. When the fistulous aperture communicates with the duct of the parotid where it crosses the masseter muscle, the establishment of a free aperture of communication with the mouth becomes almost impossible ; our efforts should therefore be directed to effect free dilatation of Steno's duct and contraction of the fistulous opening. Small fistulous apertures, too small to admit any probe, sometimes exist in the parotid region, and communicate directly with the gland. They are seldom a source of any annoyance ; they, like the openings along the anterior part of the neck, are usually congenital, and may be regarded as remains of the foetal branchial intervals which have here incompletely coalesced.

Fracture of the Malar Bone and Zygoma.

This is a rare accident. The deformity is considerable, and sometimes not easily remedied ; as in the following example :—A lad, aged eighteen, was struck on the face by a full blow from the fist of a heavy athletic man. The zygoma had given way, and also the union between the malar bone and superior maxilla. The former bone had been driven much down, giving a remarkably sunk appearance to the face, with deficiency of orbital margin. By examination from the mouth, it was also apparent that the roof of the maxillary antrum had been broken and depressed. In addition to the deformity, the patient complained of much pain ; there was a numbness of that side of the mouth ; and considerable difficulty was experienced in attempting to close the jaw, the redundant soft parts of the cheek lodging between the teeth. By pushing upwards with the finger-points, insinuated from behind the masseter, the malposition of parts was in some degree rectified ; but still considerable displacement and deformity remained. In another example, in a driver of Artillery who sustained this injury from the kick of a horse, the deformity, which was considerable, was easily removed by employing a pair of dressing forceps introduced into the mouth behind

the masseter, and pressed against the malar prominence. In all cases, till the parts consolidate, the masseter should be kept at rest by a bandage, as in fracture of the lower jaw. The zygomatic arch may be fractured by direct violence, usually from without ; sometimes, however, from within, as in a case mentioned by Duverney, in which a lace bobbin was driven from the mouth outwards in the direction of the zygoma. If there is much displacement inwards upon the temporal muscle and the coronoid, the only means of effecting elevation, without resorting to cutting down upon the bone, is to introduce a stout shoemaker's awl beneath the arch, and by the purchase so obtained attempt to elevate the depression.

CHAPTER XXXVII.

AFFECTIONS OF THE LIPS.

Harelip.

THIS term is applied to congenital fissure of the lip; the part, so deformed, being supposed to have a resemblance to the natural development of the hare. In general, there is a strong wish, on the part of the parents and friends, to trace the untoward result at birth to some sinister impression made on the mind of the mother during utero-gestation—with what success it were more curious than useful to inquire. The affection may be single or double, simple or complicated.

Single Harelip consists of a fissure, with a prolabial margin on each side, extending through the whole thickness of the lip, situate on one side of the mesial line, and either partially dividing the lip, or extending completely into the cavity of the nostril. When the affection is both simple and single, there is no other deformity in the mouth; the hard and soft palates are entire and fully developed, and the gums are normal. Deformity is great, however, even in the simplest form; and the functions of the parts are also much interfered with. The only remedy is by operation; making raw the edges by incision, approximating the fissure accurately at every point, and securing union by adhesion. The preferable period for performing this operation, probably, is after the child has passed the second year; but the operation has been successfully performed, even a few hours after birth. By the end of the second year the trying process of dentition has usually gone by; and there is consequently a better tolerance of pain and loss of blood than at an earlier period. Also, at this age, the patient, though unruly to its utmost, is yet easily managed and controlled; and the procedure is manifestly favourable to the due advancement of articulation, and the important educational results which follow. For a like reason as in extirpation of the upper jaw, anæsthesia is here somewhat hazardous; yet, with care, it may be employed safely enough—the patient's position being altered, occasionally, so as to obviate the risk of choking by blood. The child, rolled firmly up in a linen sheet—mummy-wise—with its arms by its side, is held on the lap of a nurse or an assistant, and has its head secured between the knees of the surgeon, who is seated on a chair in front of the patient and nurse; or the child is laid on a table, the head resting on a pillow. The free margin of the lip, on one side of the fissure, is taken hold of by the finger and thumb; or, better, by means of a pair of artery forceps; the point piercing the thickness of the lip just within the angle of the prolabial margin, and putting the part on the stretch in a perpendicular

direction. A straight sharp-pointed bistoury is then inserted at the upper or nasal angle of the deficiency, and carried steadily downwards, after transfixion, so as to leave a smooth cut surface on the margin of the fissure. The like is done on the opposite side. On both sides the incision should be curvilinear, so as to produce a prominence of the margin of the lip at the site of the fissure, when the raw surfaces are brought into linear contact. To secure this more completely, various modifications of this simple operation have been devised ; for instance :—Near the prolabium the knife is arrested and withdrawn, and the two flaps are left pendent. The lip is then temporarily brought together, and an estimate is made of how much of the lower part of one or both of these flaps should be retained, in order to fill up completely the notch which is otherwise so apt to remain at the prolabium ; and, this having been ascertained, the necessary abbreviation of the pendent flaps is made. The wound is then finally closed, accurately, by points of twisted and interrupted wire sutures. The ultimate success of the operation depends chiefly on the accuracy with which this co-aptation is effected, and therefore the sutures should not be introduced till all bleeding has ceased, either spontaneously or by the use of torsion. One needle close to the prolabial margin,

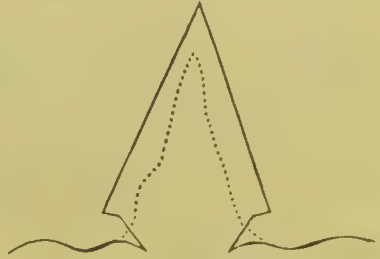


Fig. 274.

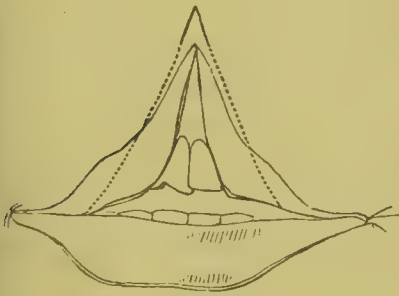


Fig. 275.

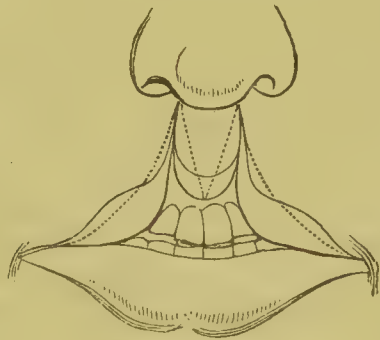


Fig. 276.

including nearly the whole thickness of the lip, except the mucous membrane, having been introduced, and the margins brought together with the fingers, the effect is observed ; and if seen to answer satisfactorily, two or three points of wire suture are introduced between the needle and the nose ; while finally the thread is wound in a figure 8 round the harelip needle at the prolabium. The point of this needle is then cut off ; and the needle itself may generally be removed in two or three days. The wire sutures should be allowed to

Fig. 274. Malgaigne's operation. The dotted lines mark the fissure.

Fig. 275. Simple harelip. The dotted lines mark the incisions, in the ordinary operation, but more of the prolabium should be removed.

Fig. 276. Single operation for double harelip. The dotted lines mark the incisions, as ordinarily practised ; but the lateral incisions answer better when made curvilinear, and terminate by dividing the prolabial margin at a point corresponding to the cut to the line of the upper incisors.

remain till union is complete, unless they seem to create irritation. After the removal of the needle a strip of plaster, applied from cheek to cheek across the lip, may sometimes be found advantageous.

To assist the sutures in their work of coaptation, pressure may be made on each cheek, bulging the lip forward, by means of a kind of truss made for the purpose. However carefully applied, and apparently useful when adjusted, yet in a restless, fractious child, in whom its use might seem most requisite, it will be found certainly displaced within a few hours, and either require constant readjustment, or, if left displaced, will positively drag upon the lip, and tend to do more harm than good.

If the fissure extends into the nose, and the ala nasi on that side is flattened, the mucous membrane reflected from the lip upon the gums should be divided, and the cheek and ala sufficiently dissected from the superior maxilla, to admit of such a degree of sliding of the cheek as will elevate the nose and diminish its gaping aperture.

In *double harelip*, there is a fissure extending from each nostril, and usually complete. The intermediate portion of lip may be fully developed, or it may be short and deficient. In the one case, two lines of wound are necessary—the ordinary operation being applied to each fissure; in the other, a single approximation will suffice—as is sufficiently illustrated in the diagram (Fig. 276).

Complicated Harelip.—Complication attends on the double form more frequently than on the single. The hard and soft palates may be cleft. Or the gum is in an abnormal state; projecting forwards between the fissures, attached to the columna and anterior extremity of the septum of the nose and central palatine arch. This central alveolar prominence bears the two central incisors, and constitutes the analogue of the intermaxillary bones which are normally present as a separate structure in some of the lower animals. The abnormal state of the palate makes no difference in the operation on the lip; except to expedite its performance, in the hope that the traction so exerted may have some good effect, in favouring diminution of the palatine chasm during progressive development of the parts. In the case where an intermaxillary bone exists, after dissecting up the portion of lip developed in connection with it, and continuous with the columna, the narrow neck of attachment of the intermaxillary bone is then divided by means of bone-pliers and its removal having been thus effected as a preliminary proceeding, the harelip is afterwards dealt with in the ordinary way. In some few cases, repression of the prominence may be effected, by adapting a spring instrument calculated to exert the necessary amount of pressure; or a Λ shaped portion of the palatal arch having been cut away with pliers, the bone is forcibly retained on the same level as the rest of the alveolar arch by means of wire sutures. This of course must be performed at an early period of life; but the union of the labial fissures may be delayed as long as is deemed expedient.

Ulcers of the Lips.

The lips are liable to ulceration of the ordinary kind; induced by exposure to weather, irritation of tartar or decayed teeth, gastric dis-

order, external injury, or direct application of an irritant cause. The prolabium is the part most frequently involved.

Treatment is begun by removal of the cause, when that is apparent ; avoiding atmospheric exposure, subduing excitement caused by external injury, removing sources of irritation from the gums, discontinuing the habitual use of a short pipe, correcting the digestive organs, etc. Then applications are made to the sore, according as its appearance may seem to require ; and nitrate of silver, either in substance or in solution, is found to be the application most generally useful—the ulcer usually partaking more or less of the irritable character. Throughout the treatment, it is of great importance to secure rest of the part as much as possible. In the child of strumous habits, ulceration of the prolabium and lining of the upper lip, near its centre, is very apt to occur, with much swelling of the part ; and in such cases the binding of a riband tightly over the lip is found to be very beneficial—securing comparative rest of the part, and promoting discussion of the swelling by pressure.

Indurated chancres are occasionally met with in this situation, and may by a careless practitioner be mistaken for epithelial cancer ; but the age of the patient, the multiple submaxillary indolent glandular enlargement, the history of the case, and the appearance of eruption, will generally suffice to indicate the true nature of this previously intractable ulcer.

Malignant Ulcers of the lips are by no means rare ; but are peculiar to the advanced in years, as *cancer* usually is ; and the lower lip is much more frequently affected than the upper. The disease may commence by carcinomatous formation of a warty character, or in a fissure, which resists treatment, becomes an ulcer, and is preceded by an extension of the hard margin which characterizes the limits of the disease. A common inducing cause is the habit of smoking with a short clay pipe ; which, saturated with the essential oil of tobacco, becomes hot, and thus irritates the prolabium—daily, or many times a day. The only remedy for the cancerous affection is by free and early removal of the diseased part ; while the ulceration is yet limited, and no involvement of the lymphatics is apparent. For superficial, suspicious sores, affecting the mere prolabium, escharotics may suffice ; nitric acid, nitrate of mercury, chloride of zinc, or potassa fusa—freely applied. But when other textures are involved, the knife alone is worthy of confidence.

When the affection is mainly on the prolalial surface of the lip, the whole may be taken away, and yet with very little deformity. By two elliptical incisions, the diseased portion is included ; the knife being entered in the middle of the prolalial space, and made to pass first on the integumental, and then on the mucous aspect of the disease. The morbid structure, thus marked, is carefully dissected out ; and then the integument and mucous membrane are brought together by points of interrupted suture.

When the disease is more superficially extensive, it is possible both to remove the diseased part satisfactorily, and to prevent any great deformity ; the margin of the lip including the disease being cut away by a horizontal incision through the whole thickness of the lip, by means of curved scissors. When again the disease extends less along the lip

than deeply towards the chin, its removal can best be effected by means of the bistoury. The including incisions are made by transfixion in the form of the letter V, the apex pointing downwards; and the incision should be carried from the central point below upwards, first in one direction and then in the other. Care is taken that the good general rule is not transgressed, of taking away a border of apparently sound texture along with the diseased structure; the limits of the disease being recognised by the extent of indurated tissue as felt by the fingers and thumb, which grasp the parts during the operation so as to steady and stretch the lip before the knife. The wound is approximated and secured, by twisted suture; as for harelip.

In not a few cases, however, almost the whole surface of the lip is involved, the disease at the same time extending deeply towards the chin. Under such circumstances, we have but one paramount indication to fulfil; namely, complete excision of the diseased part; and this is effected by the same plan of incision as just described. To effect approximation, however, both angles of the mouth must be extended outwards by incision, when the V-shaped wound, with a little dissection of the mucous membrane, will be found to come together with some straining—harelip pins and interrupted wire sutures being used to maintain the parts in apposition. While common thread sutures are introduced between the mucous membrane and the skin where the two straight incisions are brought towards the mesial line, and now constitute the free margin of the lip, one or two sutures will still be required to attach the extremities of the upper lip in their new relations with the tissues of the cheek; and then the operation is complete.

When the parts are not sufficiently lax to admit of this being effected, the lower lip may be restored by the elevation of the adjacent parts.* The operation is thus described by Mr. Syme, in a case in which removal of the cancer and restoration of the lip was done

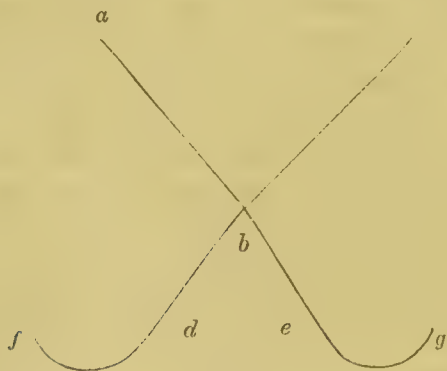


Fig. 277.

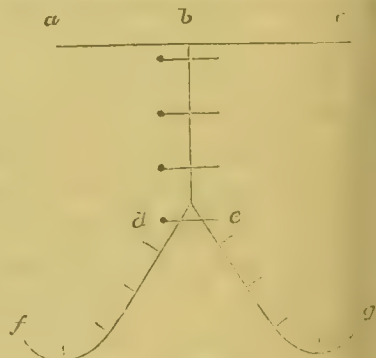


Fig. 278.

at the same time:—"Two incisions were made from the angles of the mouth so as to meet at the chin, and remove the whole of the morbid part in a triangular form. The lines *ab* and *bc* being supposed to represent these incisions, I cut from the point *b* outwards and downwards, on each side, to *d* and *e*, in a straight direction, and then, with

* See Blasius, *Klinischen Zeitschrift*, Halle, 1836. Dieffenbach, *Handbuch d. Plastischen Chirurgie*, Berlin, 1838. Serre, *Traité sur l'Art de Restaurer les Défauts de la Face*, Paris, 1842. Syme, *Monthly Journal*, March 1847, p. 642.

slight curve outwards and upwards, to *f* and *g*. The flaps *abdf* and *cbe g* were next detached from their subjacent connections, and raised upwards, so that the edges *ab* and *cd* came into a horizontal line; while those represented by *bd* and *be* met together in a vertical direction, and the lateral extensions to *f* and *g* allowed sufficient freedom to prevent any puckering or overstraining. The respective surfaces were lastly retained in contact by the twisted and interrupted suture; four points of the former being inserted in the middle line from the lip downwards, and the same number of the latter in the curved portion on each side. The wound then presented the appearance shown by Fig. 278. It healed entirely by the first intention." Should a restoration of only one side of the lip be required, this plan will be found to answer admirably, the incisions being of course confined to that side alone.

Cancerum Oris.

This is an example of Sloughing Phagedæna. It originates in the mucous membrane of the lip or cheek, and extends sometimes both rapidly and far, presenting the usual characters of that class of sore. It is almost exclusively met with in the ill-fed, ill-clothed, and ill-housed children of the poor, in densely-populated towns. But in any child of weakly habit it may be induced, by imprudent mercurialism. The constitution sympathizes greatly; in the form of irritative fever, tending to the typhoid type. Treatment consists in amending the outward condition of the patient, if possible, by change of air, ventilation, etc.; rectifying the primæ viæ; studiously avoiding all mercurial medicines; carrying out the active local treatment suitable to this form of sore; and administering internally the chlorate of potass—found to be a very appropriate alterative, in the dose of from one scruple to two scruples in the course of twelve hours. Iron also, and the liquor chlorinei, administered internally—and the latter also applied to the part, either in the concentrated form, or as a wash when sufficiently dilute—will be found very advantageous. When the case is seen at its commencement, the application of strong nitric acid, as a caustic, to the sore on the inside of the mouth, will usually check its progress. This manipulation must of course be effected while the patient is under chloroform, to secure accuracy and completeness of application. In the worst form, nourishment, tonics, and stimuli, are imperiously demanded, to prevent sinking. And if the patient survive, the loss of substance will probably be such as can be remedied only by an autoplasmic operation in after life.

Cheiloplastics.

When the lip has been lost, either entirely, or in its greater part, in a patient otherwise of tolerable health, and neither adolescent nor far advanced in years, restoration by a plastic operation may be undertaken. The part may have been destroyed by wound, sloughing, or intractable ulceration. In the last mentioned case, we must be very careful not to attempt the engrafting of a substitute, until all ulcerative tendency has for some time wholly ceased—for very obvious reasons. After removal

of truly cancerous disease, restorative interference is seldom required ; except by the operations already spoken of.

The autoplasmic operation may be conducted on the same principles as for restoration of the nose. A flap, of suitable form and dimensions, is brought from beneath the chin. A connecting slip is left at the symphysis ; there gentle twisting is made, so as to bring integument to the surface ; the part is secured in its new site by suture ; and, by the like means, a portion of the submental wound is approximated—the rest being left to heal by granulation. After adhesion of the flap is completed, the mental slip of attachment is divided, and smoothed down, by the bistoury. Where the upper lip has been destroyed by ulceration, so that a mere narrow band of tissue beneath the columna represents this part, restoration may be effected by, 1st. Detaching the remains of the lip transversely from the parts beneath ; 2d. Making two oblique or curvilinear incisions which, meeting together in the middle line beneath the columna, extend outwards through the thickness of the cheek beyond the alæ of the nose ; then, 3d. Dissecting up the cheek to the extent of the incisions, the central portion of the two lateral incisions are brought together by sutures, in a perpendicular direction, so as to form the middle of the lip, while the rest of the lines of incision are united so as to support the central portion. When loss of the upper lip is confined to one side, a portion of the whole thickness of the lower lip may be employed to occupy the deficiency. The prolabium of the lower lip should be first detached by an incision parallel to the margin of the lip, but left adherent to the central portion ; an incision is then carried from this point downwards towards the chin, and curved beneath the base of the jaw, as in Fig. 277, but only upon one side instead of both, as there represented. The large flap thus marked out is then raised, and the cicatrix corresponding to the site of the upper lip having been dissected out so as to receive it, the flap is attached in its new position by sutures. An incision is then carried through this flap, corresponding in level and extent to the mouth, upon the opposite side ; and while the prolabium which was detached from the lower lip as a preliminary to the operation is attached to the new margin of the lower lip, the mucous membrane and skin of the new upper lip are brought together by thread sutures. The remainder of the incision through the middle of the lower lip is adjusted to the parts on the opposite side where they correspond, and the gap beneath the base of the jaw left to granulate. Mr. Teale of Leeds has devised an ingenious method for effecting restoration of the lower lip in cases where, from the cicatrization of an extensive burn in the neck, the integuments of the lower part of the face have been dragged downwards. In such cases the lower lip is everted and the inferior incisors left exposed. He recommends an incision to be carried transversely across the exposed mucous membrane of the lower lip parallel to the gingival margin, from one canine tooth to the other ; from each end of this, perpendicular incisions are carried downwards to the base of the jaw and from the extremity of these incisions, two curvilinear ones extend outwards along the base of the bone. The triangular flaps thus marked out are dissected up, until sufficiently detached to admit of their being brought together in the middle line, and united one to the other.

CHAPTER XXXVIII.

AFFECTIONS OF THE PALATE.

Congenital Deficiency.

EXTENSIVE deficiency of the *hard palate* is with difficulty remediable. Mitigation of the deformity and inconvenience may be effected by the dentist ; a metallic plate being fitted into the chasm, on completion of the part's development. Also, something may be done by surgery. If, for example, a harelip co-exists, this should be remedied by early operation ; or, later in life, the operation recommended by Dr. J. M. Warren may be performed. The soft parts having been carefully dissected off the bony arch, by means of a scalpel or bistoury, curved at a convenient angle and set in a long handle, are brought together by suture, after the edges of the gap have been made raw. What filled the arch will probably meet readily on a plane surface ; but should difficulty be experienced, further relaxation may be obtained by dividing the anterior pillars of the soft velum.* It has also been suggested that a firm strong silver wire should be carried round the jaw above the alveolar arch, beneath the mucous membrane on both sides, so that both ends of the continuous wire should hang out beneath the upper lip. These are to be twisted together day by day, in the hope of so effecting a closer approximation of the two halves of the jaw. In the soft cartilaginous state of the bones, the wire, we should fear, will rather cut its way through the bone than effect closure of the gap ; and in the ossified condition, the procedure must of course be useless.

A mere fissure of the hard palate may disappear spontaneously, during the progressive development in adolescence. And if the mucous membrane should be slow in closing over, this process may be expedited by occasionally applying a heated wire, or by raising and approximating the raw edges.

The *soft palate* may be fissured, alone. Then, if the want of substance be not great, we have it in our power to attempt remedy by operation. Three circumstances, however, are essential, as preliminaries to the attempt. There must be no great deficiency, otherwise traction in approximation will be considerable, and adhesion will almost certainly fail. The patient must be of adult age, or nearly so ; great steadiness and self-control being indispensable on his part, both during the operation and afterwards. The patient should also be of sound system, and in good health ; so as to afford every possible facility to the occurrence of adhesion in the wound. And unless a concurrence of these circumstances can be obtained, the prudent surgeon will refrain from interference.

* New England Quarterly Journal of Medicine and Surgery, April 1843.

The operation is termed *Staphyloraphe*, or *Velosynthesis*. It consists of three distinct parts ; preparation of the velum, paring of the edges, and approximation of the fissure by suture. The first part requires some considerable time for its completion. For weeks before the actual operation, the patient accustoms himself to open his mouth wide, and to retain it so, steadily and enduringly—with no effort at deglutition of saliva ; and he also seeks to reduce the irritability of the parts, by frequently touching them with his finger, or otherwise. The nature of the operation is fully and candidly explained to him, and his willing co-operation secured. Before operating it is usually well to let him have a good full meal, as for several days it is desirable that all efforts at deglutition should be avoided. In operating, the patient should be seated before a good light, with the mouth widely opened, and the edges of the fissure are made raw, by a Wenzel's cataract knife or a sharp-pointed bistoury, used as in harelip ; a long volsella being employed to seize the uvular extremity of each half of the soft palate, and so to make it tense during incision. This completes the second part of the operation. Some time is now allowed to intervene, in order that the oozing of blood may cease ; and it is well to employ iced water as a gargle to facilitate this result.

The third part of the procedure consists in bringing the wound into

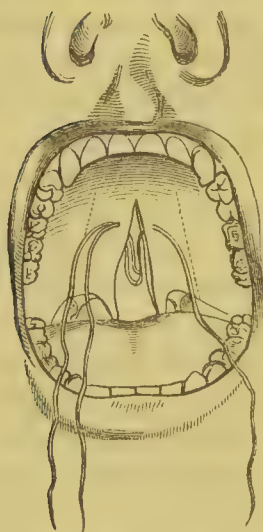


Fig. 279.

accurate apposition ; diminishing the strain on the sutures, if need be, by incision of the mucous membrane ; and keeping the part in a state of as complete quietude as circumstances will possibly allow. Approximation is not attempted until the bleeding has wholly ceased. The necessary number of silver wire sutures are passed ; taking care in their introduction to exclude the nasal mucous membrane, so that in the loop of the wire the buccal mucous membrane and texture of the soft palate shall alone be included. Not a few instruments have been contrived for facilitating the introduction of sutures in this operation—undoubtedly one requiring nicety of manipulation ; but the curved needle in a fixed handle, or a short and very much curved needle held by means of *porte-*

aiguille forceps, will be found more easily managed than any other device.

When approximation has been completed, should there be much traction upon the sutures, it has been recommended by Roux, and more recently by Mr. Pollock, to make a longitudinal incision on either side of the palate parallel to the cleft, through the mucous membrane and muscular expansions, so as to put the palate at rest and diminish traction on the line of union. Absolute starvation is not desirable. But only simple farinaceous food in small quantity should be administered from time to time ; the patient being as passive as possible in the act of swallowing. To allay irritation, the mouth may be frequently rinsed with

Fig. 279. Plan of *Staphyloraphe*. The dotted lines mark the liberating incisions of the mucous membrane.

iced water, or fragments of ice may be permitted to melt in the mouth when the part becomes hot and uneasy. Not a little self-denial is necessary, on the part of the patient, to avoid the oft-occurring excitements to coughing, hawking, and swallowing, and especially speaking; compliance with which would have a manifestly unfavourable effect upon the wound.

Mr. Fergusson practises a peculiar modification of the ordinary operation. Believing that steadiness and quietude of the parts operated on are essential to success, his method is directed to obtain this by dividing the *levator* and *circumflexus palati*, as well as the *palato-pharyngeus* and *palato-glossus*, before they pass into the structure of the palate. The main opponents of approximation being the *levatores palati* and *palato-pharyngei*, Mr. Fergusson effects the division of these muscles by an incision made by a curved lancet-shaped knife, commencing midway between the pharyngeal extremity of the Eustachian tube and the upper surface of the soft palate, and carried forwards parallel to the palatine flaps, as far as the posterior border of the hard palate. By this the *levator* and *circumflexus palati* muscles will be divided. Then putting the palate on the stretch with forceps, the *palato-pharyngeus*, constituting the posterior pillar of the fauces—and, if need be, the *palato-glossus*, constituting the anterior pillar of the fauces—on each side, is divided by means of curved blunt-pointed scissors. The rest of the operation needs no further description, as it is precisely the same as the ordinary one, consisting in the paring of the fissure and the introduction of sutures. Further experience of this operation has not led to its general adoption. Indeed, the whole secret of success seems to lie in the use of wire sutures, and in excluding the nasal mucous membrane from the loop of the suture; while, in the after treatment, the maintenance of absolute silence must be enjoined, more especially after the sutures have been removed.

By yet another method introduced by M. Cloquet, closure of the cleft may be effected. An olive-shaped cautery, heated to a cherry-red tint, is applied to the commissure of the split, at suitable intervals, till, after many burns, the space is gradually obliterated by cicatricial contraction. A long period is necessarily occupied in the work; but the means are neither painful nor hazardous, and the result though slow is sure.* Besides, as under chloroform this method is applicable to the case of children, it possesses the advantage of enabling us to cure the deformity while the patient is still of tender years, and before the nasoguttural articulation becomes so habitual as to be irremediable.

Ulceration and Exfoliation of the Palate.

The lining membrane of both the hard and the soft palates is liable to ulceration, from ordinary or specific causes. The most intractable, and not least frequent examples, are those which are connected with the syphilitic taint of system. Here the ulcer affects all the textures of the soft palate as well as the bone in the hard, producing perforation, exfoliation

* *Memoire sur une methode d'appliquer la cauterisation aux divisions anormales des certains organes, et specialement à celles du voile du palais; par M. Jules Cloquet.*

of bone, and sometimes cicatricial adhesion of the soft palate, so as to shut off the buccal from the nasal portion of the pharynx. In such cases the syphilitic affection has reached the tertiary stage, and the employment of iodide of potassium, iodide of iron, tonics, etc., constitutes an important part of our constitutional treatment ; the local applications must vary, according to the characters of the sore ; nitrate of silver, nitric acid, and liquor chlorinei, being most generally applicable.

Exfoliation of the hard palate, necessarily accompanied with ulceration of the corresponding mucous membrane, is very common in debilitated subjects suffering from the advanced stages of syphilis, and has very frequently been attributed quite as much to the poisonous effects of mercury employed for the cure of the earlier symptoms, as to the syphilis itself. In such cases mercurials are certainly quite unwarrantable, but iodine, in some form, will be found invaluable, while cod-liver oil is very useful. Locally, separation is patiently awaited ; and, when this has been completed, removal of the sequestrum is effected, if necessary. As the whole thickness of bone usually perishes, an aperture of communication necessarily results between the nasal and buccal cavities. If this be large, and spontaneous cicatricial contraction does not occur, after waiting for a period sufficient to admit of its spontaneously narrowing to the utmost, the deficiency may be supplied by a mechanical contrivance ; but gutta serena, wax, or tow plugs, made by the surgeon or patient, should not be employed, as they tend to dilate the opening. Should it resemble a merely fistulous aperture, closure of the mucous membrane may be obtained by the occasional application of a heated wire.

CHAPTER XXXIX.

AFFECTIONS OF THE TEETH.

It is unnecessary here to enter fully on the various and important topics connected with the subject of this chapter. A few leading surgical points may be stated ; reference being made, on other matters, to the various separate works which treat of Dentistry in detail.

First, it is well that the student remember how affections of the teeth are not alone connected with the convenience, comfort, and good looks of a patient—but with his health and very existence. The causes—sometimes remote, sometimes tolerably direct—of many affections implicating the general frame, as well as important parts of it, proceed entirely from the contents of the alveoli. Bad teeth “are frequently the cause—and the sole cause—of violent and continued headach ; of glandular swellings in the neck, terminating in or combined with abscess ; of inflammation and enlargement of the tonsils, either chronic or acute ; of ulcerations of the tongue or lips, often assuming a malignant action from continued irritation ; of painful feelings in the face, *tic douloureux*, pains in the tongue, jaws, etc. ;” of abscess and sinus of the cheek ; of enlargement and change of structure in the gum and alveolus, which may lead to dangerous tumour of the bone ; “of disordered stomach, from affection of the nerves, or from imperfect mastication ; and of continued constitutional irritation, which may give rise to serious constitutional disease.” In early childhood, again, the development of the teeth within their pulp cavities, and their eruption through the gums, are attended with an amount of excessive irritability which, although in popular language said to be “only teething,” may excite various forms of acute organic disease in near or distant organs ; and these, if neglected, may either prove directly fatal, or give rise to secondary results which induce this disastrous issue. It is well, therefore—as an assistance in the diagnosis and prognosis of the diseases of infancy and childhood—to be acquainted with the order in which the development of the “milk” or first teeth occurs. The two central incisors in the lower jaw are usually cut first. Next come the four upper incisors, then the two lateral inferior incisors, then the four anterior molars, then the canine, and lastly the posterior molars, constituting the complete “milk set” of twenty teeth. This process, commencing some time between the fifth and tenth months of infancy, usually lasts till the end of the second year before it is complete. During this period, and particularly the early part of it, not only does the child suffer more or less from uneasiness of the mouth and gums, attended with feverish excitement, but affections of the eyes, ears, scalp, membranes of the brain, larynx, bronchi,

stomach, and intestines, are of frequent occurrence ; requiring, while these diseased conditions are attended to, that the cause of the whole train of symptoms should not be neglected. So that, while soothing measures, as warm bathing, opiates, gentle laxatives, and even febrifuge remedies are employed, scarification of the swollen tender gum projecting over the nascent tooth or teeth should never be omitted. This operation is effected by a convex-edged penknife, or scarificator for the purpose ; and the incision should be made both over the line of the edge of the tooth's crown, and also in a direction at right angles to this, so as to make a crucial opening fairly down to the tooth.

The cutting of the permanent teeth, with the exception of the wisdom teeth, is not usually attended with much uneasiness, if we except the tender gums which often accompany the shedding of the milk set. In cutting the wisdom teeth, more particularly in the lower jaw, very great uneasiness is sometimes experienced, such as rheumatic pains in the jaws, rigidity of the masseter and temporal muscles, cynanche of an acute and erythematous type ; all of which, however, although in hysterical females possibly attended with anxious symptoms, will usually yield at once to lancing the gum and smart purgation.

Morbid conditions of Development.—In connection with various diseased conditions closely allied to scrofula, on the one hand, and to tertiary syphilis on the other, occurring in young children, or adolescents, or even adults, Mr. J. Hutchison* has recently directed attention to the condition of the teeth as indicating the existence of some constitutional affection which modified their development, while they existed within their pulp cavities. This change, though observable sometimes in the milk teeth, is usually better marked in the permanent set. These changes are characterized by the “pegged” shape of the teeth (the naturally square incisors resembling the sharp canine), by the irregularity of the enamel covering the crown, and by the tendency these teeth have to undergo premature decay. Attention to these peculiarities will frequently be found of very great use in determining the original nature of other diseased conditions, which being deeper seated do not afford the same tangible and persistent characters.

Crowded Teeth

Are usually due to imperfect or delayed development of the jaw in relation to the rapidity with which the teeth are evolved. This condition is important in a surgical point of view, as causing, posteriorly, swelling, vascularity, and ulceration of the mucous membrane ; with, it may be, repeated attacks of troublesome and even dangerous cynanche. In front, crowded incisors are very apt to cause abscess ; not confined to soft parts, but implicating the bone also, and frequently causing sinus below the chin. The remedy is plain ; to avert or retrieve disaster by removal of one or more of the crowded teeth.

* Ophthalmic Hospital Reports, 1st vol., 1858.

Caries of the Teeth

Is the term employed to denote decay of the dentine ; which decay either commences on the surface, beneath the enamel, at one or more points, and proceeds inwardly until the pulp cavity is exposed—the enamel also giving way at an early period—or beginning from without, penetrates the enamel, and thus affects the dentine. When the disease is yet recent and limited, its progress may be arrested by cutting away the disorganized substance, and “*stopping*” the cavity, either with gold or with cement. But after the pulp has been fairly exposed, and acute pain established, it may be stated as a general rule—not to be rashly or often deviated from—that under such circumstances “*stopping*” is not advisable, and extraction of the offending part is more expedient. Long to retain a decayed tooth, or portion of a tooth, in the hope of by various means quelling the pain of the toothache, and so avoiding the pain of extraction, is to court the accession of some of the more important evils already enumerated as likely to spring from such a source of irritation.



Fig. 280.

Toothache,

It is important to remember, may proceed from different causes ; and so requires different treatment in different cases. It may be an example of neuralgia—as in females during the period of pregnancy—with or without any connection with diseased teeth or gums ; requiring the ordinary anti-neuralgic treatment, local and general. It may be caused by caries of the tooth, advanced so as to expose the pulp ; and then may be palliated by anodynes ; temporarily arrested, painfully, by escharotics ; or entirely quenched by extraction of the tooth ; and the last, as already stated, is in most cases the preferable proceeding. It may arise from an inflammatory process in or around the tooth—in the interior of the tooth’s cavity, or in the alveolar investing parts—not necessarily connected with decay of the tooth at any part ; and this form is plainly to be assuaged by antiphlogistics, local and general ; locally, leeches, fomentation to the gum, and blistering the cheek ; constitutionally, saline purgatives, antimony, and low diet ; the patient at the same time affording as much rest as possible to the affected part, and specially avoiding all irritation of it by tongue, finger, or toothpick. Also, severe pain may be felt in the teeth, apparently sound, quite of a rheumatic origin and character ; and this is to be got rid of by anti-rheumatic remedies, mainly constitutional in their operation. Change of structure in the fang of the tooth—it becoming coated by rough osseous formation—may induce intense pain, though the organ be in other respects sound ; by such hypertrophy, it is probable, the nerves are incommoded and compressed ;



Fig. 281.

Fig. 280. Hopeless destruction of the teeth.

Fig. 281. Purulent cyst at the fang of a decayed tooth ; often the simple origin of most serious mischief.

and the only remedy is extraction. Lastly, the fang, or fangs, of a tooth may become necrosed, the crown and cervix remaining apparently sound; chronic abscess forms around the affected part, the matter accumulating in a distinct membranous pouch; and much pain is likely to be thus occasioned, until the tooth either is extracted, or becomes loose and permits spontaneous evacuation and discharge.

Extraction of Teeth.

Extraction of a tooth is demanded, not unfrequently, of the surgeon; as an operation of itself; or as a means towards the cure of another, and



Fig. 282.

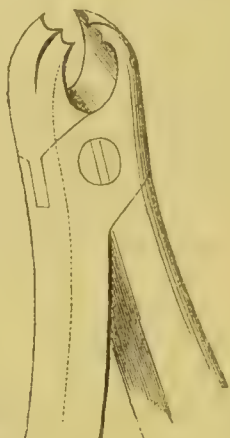
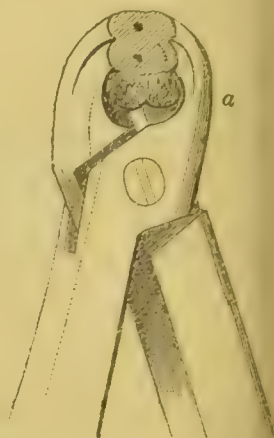


Fig. 283.



perhaps distant affection—such as neuralgia; or as part of a more serious operative procedure—as in extirpation of a portion of the jaw. Forceps and the tooth-key are the instruments usually employed. The former,

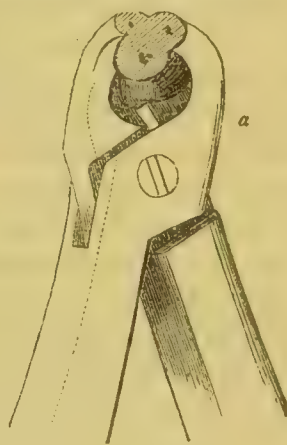


Fig. 284.

in general estimation, is by much the preferable; equally certain to effect the object in view; and possessing the great recommendation of exerting all the force on the doomed part, while leaving the alveolus and

Fig. 282. Diagram shewing the application of the tooth-key.

Fig. 283. Forceps for the upper jaw; constructed so as to adapt themselves closely to the form of the tooth. In *a*, the tooth, sawn across, shewn embraced.

Fig. 284. Forceps for the lower jaw. In *a*, the tooth embraced.

gum comparatively, or absolutely, uninjured. Practice is, no doubt, essential to the skilful and efficient use of forceps; and many instruments are required in the well-equipped armamentarium, adapted to the configuration and lodgment of the tooth to be removed. In employing either the forceps or key for the extraction of teeth, two indications should be attended to so as satisfactorily to perform this operation. 1. The instrument should grasp not the crown but the neck of the tooth. 2. As the teeth, in leaving their sockets, must break up the alveolus to some extent, the best means of effecting this with as little expenditure of force as possible, is to turn the crown of the tooth towards that side which makes the least resistance, at the same time raising it from its socket. The teeth in the upper jaw should therefore be depressed inwards towards the mouth, those in the lower jaw, with the exception of the two posterior molars, outwards towards the cheeks and lip.

Stumps are removed either by means of sharp forceps, introduced between the socket of the fang; or by a tooth-punch passed between the offending part and its alveolus, making use of a neighbouring sound tooth, if necessary, as a fulcrum.

Hemorrhage after Extraction.

Troublesome bleeding may follow the ordinary extraction of a tooth, and may proceed from one of two causes. An arterial branch, of some size and activity, may have been implicated in the injury inflicted on the alveolus. Or the patient may be one of those unfortunates afflicted with the hemorrhagic diathesis. The former case is usually manageable enough. The cavity is first cleared of clot and sponged dry by means of lint or cotton wadding crammed into it; then a saturated solution of the perchloride of iron or of matico, applied by means of a small dossil of lint or cotton, is forced down to the very bottom of the alveolus, so as temporarily to arrest the flow, and afford a dry bed for the superimposed compress. A strip of lint, steeped in the hemostatic, is then inserted firmly into the cavity, by means of a stout probe or director; and the jaws, having been brought together with a compress interposed at the injured part, are made to exert and maintain a sufficiency of pressure on the bleeding point. Or the surgeon, with assistants, may keep up the required "animal pressure" by means of their fingers. In the other case, the same local treatment is advisable, with the means suitable to the hemorrhagic diathesis.

Tartar on the Teeth.

Accumulation of salivary deposit is to be prevented, for obvious reasons; its presence being prejudicial to the gums, to the mucous membrane of the cheek and lips, and to the tongue. The teeth, though apt to loosen, do not decay, but the gums become congested, and the mucous membrane is the seat of obstinate and painful ulceration. In effecting removal, care is taken to leave the enamel uninjured. Sometimes the mass of tartar is larger than the whole range of teeth to which it is attached, and which it covers except on the free surface. The whole range is seldom equally affected.

Recession of the Gums.

In advanced years, and sometimes even in middle age, the gums recede from the necks of the teeth, especially in front, exposing the fangs; occasioning looseness, pain, irritation, and final decadence—though in other respects the organs may be quite entire. In the senile cases, but little can be done by remedial treatment; the occurrence is only a part of the general decay, and is in all respects to be regarded as such. A similar result may follow the accumulation of tartar; and then it is to be averted by removal of the offending matter. Congestion of the gums may induce it; and this cause is met by local abstraction of blood—by leeches or scarification—and by the subsequent use of astringent dentifrices. At the same time it is very necessary to look to the state of the primæ viæ, and to correct the irregularities which will probably be found there. For these chlorate of potash will often be found useful.

Injuries of the Teeth.

A tooth struck smartly may be deprived of a part of its compact structure, without any serious injury to the integrity of the rest. If, however, it have been displaced, and its vascular connection broken up, necrosis is the result. Sometimes simple dislocation occurs, without fracture.

By replacing a dislocated tooth, an imperfect union with the alveolus may take place; but the tooth will eventually lose its colour, and tend to induce an unhealthy condition of the gums.

CHAPTER XL.

AFFECTIONS OF THE JAWS.

Parulis.

THE term *Parulis* denotes the condition of *Gumboil*; inflammatory affection of the periosteum covering the alveolar process, and of the bone itself, usually connected with a decayed tooth or portion of a tooth. The swelling causes much pain and discomfort, sometimes with smart constitutional disturbance. On suppuration taking place, relief is obtained by evacuation of the matter; but so long as the decayed tooth remains, a certain discharge, with swelling and pain, continues to prove the source of no slight annoyance, giving rise to suppuration and sinus of the cheek, in the instance of the upper jaw; and along and below the base of the lower jaw, when any of the lower range of teeth are thus affected; while discharge from the nasal cavity, and affections of the antrum, eyeball, pharynx, and digestive organs, may be induced as a consequence of such long-continued irritation. Treatment varies according to the stage of advancement. At first, the affection just originating, the decayed tooth should be removed at once, and bleeding from the wound encouraged; and afterwards, if need be, blood may be further withdrawn by leeching the affected part—the animals being most conveniently applied through a glass tube. When matter has formed, it should be early and fully evacuated; and after the excitement following incision has abated, under ordinary antiphlogistic means, the offending tooth or stump should be extracted. To perform extraction earlier, might be to aggravate the inflammatory process unnecessarily.

When the matter has formed and been discharged, extraction of the tooth will ordinarily suffice for effecting contraction and closure of the discharging aperture, with subsidence of the swelling and pain. If not, some of the many suitable astringent solutions may be applied to the part. The removal of the offending tooth will always cure the other more remote affections, of which it may have been the cause.

Epulis.

Epulis denotes a solid tumour of the gum, of non-inflammatory origin; but often in its commencement connected with the presence of a decayed tooth, or portion of alveolus. It may be either simple or malignant. The simple form originates either in the periosteum of the alveolus or in the bony texture itself; the surface from which it proceeds is generally limited, and rarely includes more than the alveolar ridge of three or four teeth. The excrescence is of firm consistence, lobulated or

irregular surface, and whitish aspect—at all events, not more vascular than the surrounding normal gum. It increases slowly in size, loosening and displacing the teeth in the neighbourhood; those occupying the gum in the situation where the tumour has originated, becoming either irregularly placed upon the surface or extruded. When left to itself, although it may attain to a very large size, impeding articulation, deglutition, and even respiration, the body of the bone has no tendency to become affected—the tumour developing itself under the mucous membrane and towards the mouth.

In the superficial form, it is sufficient during the early stage of its development to remove the tooth implicated in the growth, and to excise the morbid structure by means of the knife; repressing subsequent tendency to growth, if need be, by the application of an escharotic. When the bone is involved, it is essential that the affected portion shall be taken away; and this is readily effected by removing a tooth on either aspect of the alveolar margin from which the tumour is developed, and cutting through the sound bone beyond by means of curved cutting-pliers.

The malignant form is more rare. At a very early period not only is the bone affected, but the mucous membrane of the gums and cheeks becomes involved; the surface ulcerates and fungates; and the disease is attended, like other instances of medullary disease, with severe pain, a cachectic aspect, and a profuse bloody loathsome discharge, while it spreads rapidly in all directions. Obviously, the only remedy is by ablation; and that at a comparatively early period.

Sometimes, malignant disease commences in the mucous membrane covering the gums of the upper jaw, not with the formation of tumour, but at once by ulceration—a form of epithelial cancer. The loss of substance speedily destroys the alveoli and their contents, and, opening into the antrum, with implication of the masseter, coronoid process, and the pterygo-maxillary fossa, discloses a foul and hideous sore, which is usually, from an early period, quite beyond the reach of surgical interference.

Tumours of the Lower Jaw.

The lower jaw is liable to be the seat of abscess, and of cystic disease, as well as to be occupied by both osteosarcoma and osteocephaloma. Abscess usually forms in connection with and around the fang of a decayed tooth. When the affected tooth is situated anteriorly, the abscess rarely attains to a large size, and usually opens either towards the mouth or beneath the symphysis or base of the jaw. Posteriorly, where the bone is thicker, the collection of matter may be confined by dense osseous walls supporting the granulating membrane which lines the abscess-sac. Such cases are rare, and may readily be mistaken for solid tumours forming within the bone and gradually extending outwards. The presence of a decayed tooth, or a yielding point on the inner or outer side of the alveolar margin, should always excite a suspicion that an abscess exists within. In such circumstances the removal of the tooth, followed by a free opening made into the cavity of the abscess by means of a trephine should be had recourse to.

In cystic disease of the lower jaw, the irregular ovoid form and varying resistance of the crackling walls of the tumour, under the pressure of the surgeon's fingers, will usually suffice to indicate what is the nature of the formation. Where this consists of one, or at most a few large cysts, the best practice is to lay them freely open by means of a stout bistoury and curved scissors, or cutting-pliers, and stuff the cavity; then, after the subsidence of the inflammatory effects following upon this manipulation, contraction of the expanded bone will generally ensue, and the parts be restored to nearly their normal condition. When, however, this has been fairly attempted and failed, when the cysts are numerous and endogenous, and cystic growths are felt to exist in the walls of the larger cysts—and when especially there is a solid tumour combined with the cystic formation—excision of the whole extent of bone implicated in the disease should be practised without further delay.

The solid tumours require the same treatment as in the upper jaw. But, with this difference, that, in consequence of the relative anatomy of the parts, complete ablation of a medullary growth is within our power at a much more advanced period, than in the case of the superior maxilla; inasmuch as, if the soft parts are not involved, the whole diseased structure of bone is included, and can be taken away by removal of the condyles of the bone.

The simple *Osteoma*, or hyperplastic osseous development, occurs in the lower jaw; and should be distinguished from progressively enlarging morbid formations in this part—the bony thickening usually yielding to the removal of any local source of irritation, the employment of counter-irritation, and the administration of iodine. Should these fail, a grave suspicion may be excited that a tumour developing within the bone really exists, requiring then, if the enlargement continues progressively on the increase, the extirpation of the affected part.

Epithelial Cancer affecting the lower lip may extend along the mucous membrane, and at a comparatively early period implicate the alveolar portion of the symphysis. In such cases, if no glandular enlargement forbids operation, the portion of bone implicated may be removed along with the lip. In one case where a single gland was enlarged and attached to the inner aspect of the jaw, removal of the lip, jaw, and gland in one mass, was followed by a satisfactory result.

The lower jaw is sometimes the seat of *osteo-aneurism*. The disease is liable to be mistaken for a cystic affection of the bone, and accordingly incisions have been made into the enlargement under the impression that the tumour was of the cystic kind. When the true nature of the disease becomes apparent, removal of that half of the jaw in which it occurs should be practised.

Extirpation of the Lower Jaw.

Excision of the whole bone from condyle to condyle has been practised, as a single operation, on account of tumour, in at all events two cases; one by Walther of Bonn with a successful result, the other by Mr. Syme in November 1843. The whole bone has, however, been frequently removed by two operations; the second being required on

account of a return of the disease in the remaining portion of bone.* From such a very limited experience of the complete extirpation of the jaw at one operation, it is impossible to decide upon the success which is likely to attend upon its repetition. Apart from cases of necrosis of the bone from condyle to condyle, which of course, in the removal of the sequestrum, afford no true analogy to the operation for tumour, various cases are on record where the entire maxilla has been shot away, or torn off by accident. There appears, therefore, no reason to fear that either the immediate or consequent effects of the operation should necessarily determine a fatal issue, and therefore no reason on account of hypothetical objections which may be raised to refuse our sanction to the performance of such an operation in suitable cases. In performing this



Fig. 285.

operation, an incision is carried along the margin of the ramus of the jaw and its base, from articulation to articulation; the soft parts, dissected off, are turned up over the face as a flap; the articulation on one side is opened by Cusack's method from the front; depressing the bone, and dividing the temporal muscle, the condyle is started from its socket first on the one side and then upon the

other; after which the soft parts attached to the interior of the bone are carefully divided, the knife being directed against the surface of the tumour; and the attachments of the muscles of the tongue to the symphysis are divided last of all.

Partial removal of the lower jaw is a very common operation; and, as formerly stated, when undertaken on account of genuine osteosarcoma is usually followed by a fortunate issue. Partial excision of the lower jaw includes the following operative procedures:—1. Excision of one-half from symphysis to condyle. 2. Excision of the symphysis, and more or less of the base on both sides. 3. Excision of the base on one side. 4. Excision of the condyle and coronoid process as far as the angle of the bone.

The removal of one-half of the jaw is effected as follows:—The incision is commenced over the articulation, and continued downwards and forwards, along the posterior and inferior borders of the bone, first on its ramus and then on the body, to a point a little beyond that where it is intended to divide the bone. The soft parts are dissected off the surface of the tumour so as to expose it fully, leaving the mucous membrane undivided till near the conclusion of the operation, so as to avoid blood flowing into the cavity of the mouth during the remaining steps of the procedure. The bone anterior to and beyond the confines of the tumour should then be cleared of soft parts, so as to admit of a small saw being applied to cut through the base of the bone. The cutting-pliers are introduced into this notch, and the division of the bone completed. The soft parts attached to the inner aspect of the base of the jaw are next

* *Lancet*, No. 1557, p. 8.

carefully dissected off the surface of the tumour, the anterior part of the bone being drawn outwards so as to effect this more safely. The mucous membrane is then divided, and the whole jaw is depressed so as to bring the attachment of the temporal muscle to the coronoid process within reach of the knife; its tendon is cut through, and the internal pterygoid muscle divided; then, depressing the tumour and drawing it outwards, the joint is opened on its anterior aspect, and partly by twisting, partly by the careful use of the knife, disarticulation is effected so as to avoid wounding the internal maxillary artery, where it passes between the internal lateral ligament and neck of the bone. The bleeding vessels are tied at the upper end of the wound; and should the joint have been disarticulated as directed, there will be no occasion for securing either the internal maxillary, or common trunk of that vessel and temporal, as was recommended by Mr. Liston. Both ends of the facial artery, which is divided at the commencement of the operation, should be tied after the soft parts have been dissected from the tumour, before applying the saw, as in this way bleeding is prevented. A folded piece of lint should now be laid in the cavity from which the tumour has been removed, the flap is then replaced, and retained by suture; the integrity of the lower lip in front obviously contributing much to the facility of accurate adjustment, and to the appearance of the patient afterwards. The wound generally heals by adhesion; the interior suppurates, but the discharge of matter takes place into the mouth. Dressing of the interior is conducted as in the case of the upper jaw; and cicatrization with more or less puckering in like manner results. During the process of consolidation material benefit will be obtained from the use of a mechanical contrivance, adapted to the teeth of the upper and lower jaws, whereby overlapping and displacement of the remaining portion of the lower jaw is prevented. "Metallic caps are fitted to the teeth of the upper and lower jaws of the sound side, and are riveted and soldered together at their bases, so that, when applied, they shall have the effect of preventing the dragging of the remaining portion of the bone and chin to the opposite side by the external pterygoid, mylohyoid, and digastric muscles, and by the elasticity of the soft parts. This apparatus should be worn for many weeks after the operation."* Contrivances may also be temporarily worn, on the injured side, to prevent undue shrinking of the cheek during granulation. Where the tumour does not invade the neck and condyle of the bone, it will be found advantageous to terminate the external incision about an inch below the articulation, even should we determine on effecting disarticulation, as in that way we avoid division of the *portio dura*, which crosses the ascending ramus of the bone at this point. The operation is performed in other respects as already described, except that the disarticulation is effected by twisting the bone out of its socket, and cutting the textures upon the neck of the bone as they are exposed when the tumour is drawn downwards and backwards.

Sometimes it is necessary to remove the symphysis along with one-half of the jaw; the tumour being so extensive. This is effected by such a form of incision as recommended for disarticulation with section at the symphysis.

* LISTON'S Practical Surgery, p. 318.

A tumour implicating the body of the bone only, on one side, may be removed by a similar but less extensive incision ; section of the bone being made at the angle and symphysis. But the propriety of such a proceeding is very questionable, in cases of medullary tumour. For experience has shewn that, in such cases, return of the disease is very apt to take place in the truncated ramus. Should this occur, any difficulty which the absence of the base of the jaw might be supposed to occasion in enabling us to depress the bone, when dividing the attachment of the temporal muscle to the coronoid process, may easily be overcome by the use of a pair of "gripe" forceps, or even incisor tooth forceps, by which to grasp either the truncated ramus of the bone or its condyles.

When the tumour occupies the ascending ramus of the bone between the angle and its condyle, if it is of a simple kind the removal of that portion of the jaw implicated in the tumour is alone requisite ; and this operation can easily be performed without opening into the mouth. Should the tumour be of some size, it will be expedient to be provided with the gripe forceps, already mentioned, as enabling the operator to control the movements of the tumour, and expose its attachments in effecting their division.* In cases of cystic tumour occupying this portion of the bone, great care and attention will be requisite to avoid opening the cysts while the dissection, division of muscular attachments, and disarticulation, are being effected.

The symphysis may be removed on account of tumour. A horizontal wound, made along the lower border of the bone, will sufficiently expose the tumour to enable the bone to be divided by the saw and pliers beyond the disease. After excision has been effected, some care of the tongue is necessary ; lest after division of its anterior attachments it should be unduly retracted, and threaten asphyxia. To obviate this, the organ may be temporarily restrained, either by ligature or by forceps ; this, however, is only necessary for a few hours, at the end of which the patient will usually be found to have sufficient control over the organ to prevent its being drawn backwards into the pharynx.

Sometimes it is expedient to remove a portion of the jaw, on account of ulcer or tumour of the soft parts which has implicated the osseous tissue secondarily. One paramount indication must in all such cases be fulfilled : to remove the whole of the morbid structure, and to cut wide of the disease.

During these operations on the mouth, it is plain, for reasons formerly assigned, that chloroform must be used warily, and the patient allowed to emerge from deep stupor when blood is flowing into the pharynx from the mouth. By incising the mucous membrane, however, only at the close of the operation, and dividing the bone from the base towards the alveolar margin, by which the necessity for extracting teeth is avoided, bleeding into the mouth can only occur at or towards the completion of the operation ; so that, except in disarticulating, tying the vessels, and introducing the sutures, the patient may be kept quite unconscious with perfect safety.

* SYME, London and Edinburgh Medical Journal, 1843, p. 964.

Caries and Necrosis of the Lower Jaw.

The lower jaw is liable, like other bones, to these common affections. But, in the present day, it suffers much less frequently and extensively in this way, than it did when mercurialization was more in vogue for venereal affections—real and suspected. Many teeth, large portions of the jaw, and even the greater part of the entire bone, not unfrequently were tediously and painfully discharged, as worm-eaten sequestra; causing much disturbance, both local and general, at the time, and great subsequent deformity. When either of these affections do occur, the general principles of surgery are brought to bear on them; by treatment partly local, partly directed to the system. In removing sequestra and exfoliations of the jaw it is always desirable to reach the dead bone, if possible, by laying open the sinuses which open into the mouth, so as to avoid further disfigurement of the face. Any incisions that are made upon the surface should be confined to the submaxillary aspect of the base of the bone.

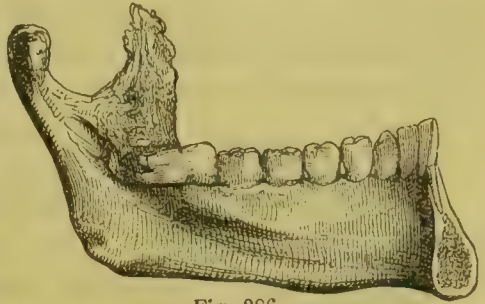


Fig. 286.

Necrosis of the lower jaw, from the agency of hypophosphoric and phosphoric acids, generated in the manufacture of lucifer matches, has been already alluded to, p. 297.*

Fracture of the Lower Jaw.

The lower jaw may be broken by violence applied either directly or indirectly. Fracture near the middle of the body of the bone may be the result either of a blow delivered on the symphysis, or of injury indirectly sustained by the part fractured. The base of the bone, at or near the bicuspid teeth, is most frequently injured, but all parts are liable. The fracture may be confined to one side, sometimes it exists in both. The ramus has been fissured, the condyle has been broken off, the coronoid process has been snapped through, and the symphysis itself sometimes, but rarely, gives way. The fracture may be either simple or compound, often comminuted. There is always laceration of the gum, with consequent hemorrhage into the mouth, and exposure of the fractured ends in that direction, when the fracture occupies the base of the bone. The signs of the occurrence are sufficiently plain; by deformity, crepitus, loss of power, and evident displacement. The mental portion is usually displaced downwards and inwards, by muscular action and its own weight, while the portion near the angle of the jaw is displaced

* *Vide* also LANCET, No. 1367, p. 498. Heyfelder, Archives Gen. de Méd. Oct. 1845, p. 204.

Fig. 286. Ulcerative destruction of the coronoid process of the lower jaw, caused by "the awkward position of the wisdom tooth." The patient "perished in consequence of the extensive abscesses of the mouth and neck."—LISTON.

in a direction outwards; but in many cases there is no displacement whatever.

Fractures of the ascending ramus and neck of the bone, if obscured by swelling, can easily be detected by introducing the finger into the mouth, feeling for the styloid process, immediately in front of which the condyle of the jaw will be felt, and thus manipulating the parts while the mouth is opened and closed. Should the condyloid fragment be displaced inwards, by the external pterygoid, its reduction may likewise be effected in this manner, as was first distinctly pointed out by Ribes.

Reduction is in most cases easily effected; and, usually, retention is not difficult. The fragments should be carefully adjusted in correspond-



Fig. 287.

ence with the teeth in the upper jaw. The jaws having been firmly closed, a pasteboard splint is adapted to the exterior surface; and the whole is retained by a four-tailed bandage. Some recommend that two wedges of cork, sloping gently backwards, with their upper and under surfaces grooved for the reception of the upper and lower teeth, should be inserted on each side of the mouth, as a means of securing accurate apposition of the fragments. They are mainly of use when fluid food cannot be introduced through the clenched teeth, or when, from deficiencies in the teeth, the jaws cannot be satisfactorily locked against

each other; and in such circumstances, gutta percha softened in hot water can generally be more readily modelled to serve the purpose than any other material. In cases of double fracture of the base of the jaw, if firm teeth occupy the verge of each fractured portion, it has been recommended to bind these together by wire, as a means of effecting better apposition. This is attended, however, with the risk of loosening the teeth so deligated. Teeth quite detached should be removed at once; and so ought fragments of bone similarly circumstanced—in cases of comminution. For some time, usually between a month and six weeks, the patient must be content with such articles of food as require no mastication; and all movement of the fractured part must be avoided. It is rare to meet with deformity as a result of fracture of the jaw except in cases of very great comminution, loss of bone, or absence of all treatment; and want of union may be said practically not to occur. In gunshot fractures of the lower jaw, the copious fœtid suppuration, flowing into the mouth and swallowed by the patient, always induces great gastric disturbance, with more or less typhoid symptoms. This may, indeed, be due to the occurrence of Pyæmia; but by Dupuytren, in the latter years of his life, it was attributed to the swallowing of the discharge; and to remedy this he recommended free incision, removal of the fragments, and resection of the bone beyond the injured part. Extreme comminution of the bone could alone justify the adoption of such a severe measure.

Fig. 287. Four-tailed bandage, applied to secure the lower jaw.

Dislocation of the Lower Jaw.

Dislocation of the jaw can only occur forwards, and during the existence of teeth in the jaws; being exceedingly rare in the two edentulous periods of life. In this displacement the condyles rest in front of the base of the zygomatic process, and, according to Nelaton, the coronoid processes on the edge of the malar bone external to its tubercle.* The accident may be double or single; according as both or one of the condyles are displaced. And it may be the result of mere muscular action, as in yawning or retching; or of force applied to the symphysis, with the mouth more or less open. When the mouth is opened widely the condyle rests upon the articular eminence, so that it only requires laceration of the capsule, and sudden contraction of the external pterygoids and a portion of the fibres of the masseters, to complete displacement. The symptoms are so characteristic as not to be overlooked. The mouth gapes, and cannot be shut; the chin is depressed and advanced, and saliva trickles over it; the condyloid space is vacant, and a prominence is felt beneath the zygomatic process; considerable pain is experienced, articulation is very indistinct—perhaps impossible—and deglutition difficult.

Reduction is effected by a combined movement; depression of the angle, elevation of the symphysis, backward pressure on the coronoid processes, and traction forwards of the whole bone. Thus the jaw is extricated from its entanglement; and, brought within the uncontrolled play of the muscles, is by them pulled back into its normal position. In some cases further assistance is obtained by depressing the chin before attempting the combined "downwards, forwards, and backwards" movement. The manipulation for reduction in the ordinary manner is as follows. The thumbs, placed over the last grinders, within the mouth, depress the angles of the bone and serve as a fulcrum; the rest of the hand, grasping the chin and base of the jaw, makes the forwards extension, while elevation of the symphysis disengages the condyles from their abnormal position; an assistant may at the same time assist the muscles in drawing back the bone into its place, by pressing back the coronoid processes. In order to protect the thumbs, a towel or other soft substance may be wrapped round the distal phalanx; should this precaution not be employed, so soon as the jaw is felt to move they should be slipped from between the teeth to the outer side. If any difficulty in reducing the dislocation is experienced, chloroform should be administered, and one side should be reduced before the other. For some days afterwards, the motions of the jaw should be very limited; and in most cases it is well to restrain them by a bandage. Reduction has been effected at so late a period as ninety-eight days after the occurrence of the accident (Donovan, Dublin Med. Press, 25th May 1842); and by Sir A. Cooper and Stromeyer, each after the lapse of thirty-five days. Unilateral displacement may be very closely simulated by chronic rheumatic arthritis of the temporo-maxillary articulation.

* Nelaton, *Memoires de la Societ  de Chirurgie de Paris*, 1849; et *Elements de Pathologie Chirurg.* Paris, 1847-48.

Anchylosis of the Jaw.

This may be spurious or real; the result of change in the soft parts or in the hard. Mastication, deglutition, and speech, are seriously interfered with; and the patient anxiously seeks relief. This may be afforded by the knife alone, when cicatrices are in fault; dividing adhesions, and preventing reunion by careful dressing subsequently. Sometimes, in addition, subcutaneous section of the masseter is advisable. When rigidity is extreme, and depends on true anchylosis, which is extremely rare, it may be necessary to operate on the jaw itself, in order to prevent death from inanition; cutting through the neck of the bone on both sides, so as to make a false joint; or removing a central portion entirely, for the admission of food; or fracturing the bone by the use of two screw wedges, by which the jaws may be forcibly separated.

CHAPTER XLI.

AFFECTIONS OF THE TONGUE.

Glossitis.

THE inflammatory process in the tongue may be variously induced; by wounds, stings, or other injuries; or by acrid applications. Or it may occur spontaneously. The symptoms in the acute form are—pain, rapid swelling, with more or less protrusion, intense thirst, with, of course, impairment of the ordinary functions of the organ. In extreme cases, the swelling may occlude the fauces, and has even proved fatal by causing suffocation.

The treatment, when there is no great urgency in the symptoms, should consist in applying leeches and fomentations to the submaxillary region, with the use of such antiphlogistics internally as may seem necessary—purgatives being specially indicated. In cases where the symptoms are rapidly induced, threatening to produce suffocation, two or three free longitudinal incisions, as if for phlegmonous erysipelas, should be made into the dorsal surface of the tumid organ. This affords speedy relief, by the escape of blood and serous fluid; the swelling rapidly abates, the wounds, which at first were gaping and deep, dwindle down to mere scarifications, and no important lesion of structure is inflicted on the part. Should a case present itself too urgent to admit of waiting for the effects of incision, or should the incisions not afford sufficiently speedy relief, tracheotomy should at once be performed, so as to protect the patient from the risk of suffocation.

Where glossitis is due to the excessive administration of mercurials, the swelling is gradually induced, and is by no means so extreme as in the acute form just described. The organ sometimes protrudes considerably from the mouth, and may become very extensively ulcerated on its under surface from the constant pressure of the inferior incisors. Purgatives, support of the organ by means of a bandage, the use of astringent lotions, and the internal administration of chlorate of potash, should constitute the principal part of our treatment.

Wounds of the Tongue.

Wounds of the tongue bleed copiously. Hemorrhage is to be commanded by iced water, by ligature, by a harelip needle and thread twisted round it, or by the use of styptics—sometimes advantageously combined with pressure effected by means of common dissecting forceps, the blades being compressed together by an elastic caoutchouc ring, or by means of Desmarres' ring forceps for operations on the eyelids; if need be, the

cautery may be applied. In uniting the wound, after bleeding has ceased, it is plain that we can avail ourselves with most advantage of the common interrupted wire suture. In the slighter cases, the use of sutures may effect not only approximation but also a hemostatic result. Union rarely occurs by the first intention, but the sutures should be retained as the only means we can employ for securing coaptation of the parts during cicatrization. A very considerable degree of pain, swelling, and buccal irritation sometimes occurs for some days after the infliction of a wound of the tongue, which is best allayed by iced drinks, frequent washing of the mouth, and, afterwards, the employment of astringent and aromatic gargles.

Ulcers of the Tongue.

Ulcers of the tongue, like those of the lips and cheeks, may be either simple or malignant. The former may depend on local irritation, as from tartar or decayed teeth; or on gastric or biliary derangement; or on a general febrile condition; or on a syphilitic state of system; or on the occurrence of mercurial poisoning. In the first of these cases, the ulcers are small, irritable, with a yellowish surface and red margin, and correspond to the existence of a tooth or teeth with sharp edge or encrustation of tartar; in the second, they may consist of aphthous patches, or present the character of irritability already mentioned, and are situated generally around the margin and upon the under surface of the organ, which is usually flabby, marked by the teeth, coated on the surface, and accompanied by more or less foetor of the breath. In syphilitic cases in the *secondary* stage, the ulcers consist either of whitish, oval, oblong, or crenelated elevations of the surface and margins of the organ, or of chaps and superficial excoriations, as if the epithelial surface had peeled off in patches; in the *tertiary* stage, one or two deep and long ulcers occur, with hard margins and a sloughy-looking surface, implicating the deep textures of the part. In the mercurial cases, the whole organ is usually implicated, presenting a smooth, glossy, whitish aspect of surface, devoid of papillæ, with some hardening of its structures, and partial or complete alteration in its form. The constitutional treatment of such different conditions, it is obvious, must vary accordingly. The preferable local applications are—nitrate of silver or sulphate of copper, either in substance or in solution, and frequently applied; and, in obstinate cases, nitric acid or the fluid pernitrate of mercury, applied at long intervals.

The malignant ulcers are attended with the usual characters of hardness, pain, excavation, and want of distinct definition, the margins being usually composed of projecting and hard granulating masses, implicating the textures of the tongue for some distance. Such ulcers are usually situated laterally, and frequently far back. They may be taken away by the partial or complete removal of the tongue. The former or partial operation is effected by excision with knife or scissors—after grasping the part and forcibly drawing it forwards by a sharp hook or volsella—by ligature, by the *ecraseur*, by the galvano-caustic wire, or by means of the actual cautery. The latter, or total extirpation of the organ, may be effected as recommended by Regnoli,* for the partial removal of the

* Regnoli, *Bulletine delle Scienze Mediche*, Jan. 1839, No. 131.

tongue, when the disease is situated in its posterior parts. By an incision carried along the base of the jaw from angle to angle, a flap of integumental texture is marked out and dissected downwards, the floor of the mouth is opened by carrying the knife along the inside of the base of the jaw, the tongue is drawn downwards through this incision by a volsella, and dissected off from its lateral and hyoid attachments, and the vessels are tied as divided. The flap is then replaced and retained by sutures, and the patient is fed, till he can swallow, by passing the feeding tube. Mr. Syme has, in two cases, removed the entire tongue by a straight incision from the middle of the lower lip to the hyoid bone, dissecting back the integuments, dividing the lower jaw at its symphysis, detaching the tongue on each side from the base of the jaw, and lastly cutting through its hyoid attachments. His example has been followed by Drs. Fiddes of Jamaica, and Paul of Elgin, and by Mr. Nunnally of Leeds. The *ecraseur*, and deligation by means of whip-cord, have also been employed to remove the whole organ, with or without preliminary dissection of superficial parts.* The result of experience in the partial and complete removal of the tongue has not been of a kind to encourage any hope of affording permanent relief; operations therefore should only be undertaken as a means of palliation, and this can be effected most satisfactorily by a partial removal when the disease is situated on the tip or edge of the organ, due care being taken that the whole of the diseased part, with a border of apparently sound texture, is included by the incisions.

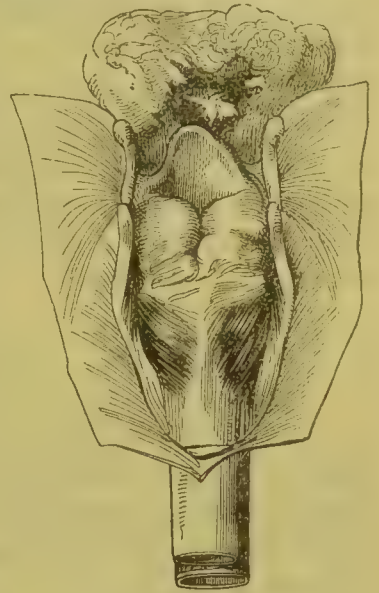


Fig. 288.

Persons of advanced years should be very careful to avoid all continued irritation of the tongue, as by tartar, false teeth, etc., lest troublesome and ultimately malignant ulceration be induced.

Hypertrophy or Prolapsus of the Tongue.

In young persons the tongue is occasionally the seat of simple chronic enlargement; and this is probably always congenital. The normal texture is expanded; and the papillæ greatly enlarged. Much inconvenience necessarily results; even at an early period of the case. The growth progresses with the development of the child, and is materially accelerated by dentition and febrile disturbance of the system. Ultimately the tongue protrudes; assumes a more globular form; has a brownish irregular surface, and is fissured beneath by ulceration occa-

* Mirault, Gazette Med. de Paris, vol. ii. p. 507, 1834; Arnott, Med. Chirurg. Trans., vol. xxii., 1839.

sioned by the contact of the organ with the teeth in the lower jaw. A wasting discharge of saliva necessarily results, and deglutition, articulation, and even breathing, may be interfered with. The lower anterior teeth become displaced, and the lower jaw, in its anterior part, is altered in form.

The treatment is by rectification of the *primæ viæ*—usually very prominently disordered; sometimes repeated leeching of the part is useful; and the internal administration of the iodide of potassium may be advantageous. Bandaging of the protruded part, with the application of astringent lotions, should, however, constitute the principal part of the cure. And such means, patiently employed, will generally prove successful. But should they fail, wholly or in part, it may be necessary to remove a portion of the apex, of a wedge shape, and of such a size as to restore the organ to something like its normal bulk, on approximation of the wound's edges; at least rendering the tongue capable of residence within the mouth; so removing the principal deformity and inconvenience—protrusion—and reducing the risk of excessive inflammatory change in the wound.*

Induration of the Tongue.

Localized indurations of the tongue precede the formation of the tertiary syphilitic ulcers of this organ, already mentioned. In their early stage they may resemble a pea, plum-stone, or filbert, situated in the deep textures of the central part; then the mucous membrane becomes adherent to their surface, they soften, the surface ulcerates, and a yellowish sloughy sore is disclosed. There is rarely more than one of these indurated masses present at one time; they are usually indolent in their nature, and, until softening commences, painless. The existence of other symptoms of the syphilitic diathesis will aid the diagnosis; and the student, in giving an opinion, should recollect that in such cases the general appearance of the part may closely simulate malignant disease, to one not practically acquainted with the characters of these affections.

The treatment should consist in the use of iodide of potassium, combined with iron, or other tonics, and good food; stimulating the surface occasionally by applying nitrate of silver. When the ulcerated condition is present, the applications already mentioned should be employed.

Erectile Tumour of the Tongue.

The erectile tumour may form in this organ. A few examples are on record. If the diseased structure be limited, prominent, and accessible, it is to be removed by inclusion in ligature. If it involve the whole organ, or be otherwise not suitable for deligation, attempts may be made to induce a change of structure, by the employment of some of the methods spoken of in the chapter upon aneurism by anastomosis—calcu-

* Lassus, *Pathologie Chirurg.* t. ii. p. 160; and *Mem. de l'Institut. National*, vol. i. p. 66; *London Med. and Physical Journal*, 1801, vol. vi. p. 353. *Edinburgh Med. and Surg. Jour.*, vol. i. p. 317. Mr. Crosse, *Memoir*. Sympson, *Observations in Clinical Surgery*, p. 180.

lated to produce plastic change, or even partial sloughing of its texture—the introduction of a heated awl or broad needle, in various directions, being of these apparently the most suitable. Failing this, the disease must be regarded as beyond the reach of our art. Deligation of both lingual arteries has been practised; but with a result which does not invite repetition; fatal sloughing of the organ having ensued.* In one case mentioned by Brown, the tumour situated on the lateral aspect of the tongue was making rapid progress, but after an accidental salivation, attended with great swelling of the whole organ and buccal cavity, the disease became arrested.

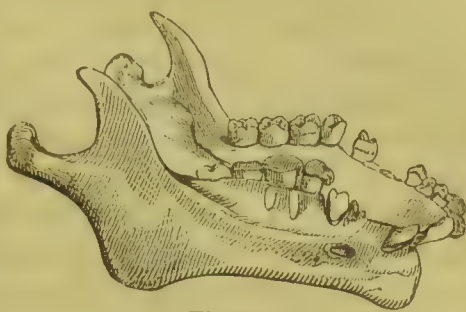


Fig. 289.

Division of the Frænum.

In the child, the frænum linguæ may be so short as greatly to incommode the organ, constituting “tongue-tack;” at first impeding suction, afterwards embarrassing articulation. Or the defect may be more accurately expressed, perhaps, as an abnormal prolongation forwards of the frænum, tying down the apex of the tongue. Cases are, however, frequently brought to the surgeon in which this condition is believed to exist, but where the inability to suck or articulate will be found due to some other cause than any abnormal condition of the frænum. When the tip of the tongue can be raised above the level of the gums, and can be made to touch the palate, or to protrude so as to touch the lips, we may be sure there is no “tongue-tack.” The free margin of the faulty texture is readily divided, by means of probe-pointed scissors—the point of the tongue being elevated, so as to stretch the part, by fingers introduced on each side of the frænum; cutting only the free margin of the band, the finger nail is employed to complete the separation to the required extent, and so troublesome bleeding by wound of the ranine vessels is avoided. During healing, the part should be manipulated occasionally so as to prevent recontraction.

In the adult, a somewhat similar condition may supervene, in consequence of troublesome suppuration beneath the tongue. During cicatrization, the apex of the organ is drawn down, and becomes confined by a dense band of adventitious formation. This spurious frænum may be dissected through; and, by dint of careful dressing, a more favourable cicatrix may be obtained.

Ranula.

Ranula denotes a tumour, formed beneath the tongue, in consequence of obstruction, it may be, in one or both of the salivary ducts. In such

* Liston's Elements of Surgery, p. 409.

Fig. 289. Expansion of the lower jaw; the result of pressure by the tongue, enlarged by erectile tissue.—LISTON. *Vide* his Elements of Surgery, p. 410.

cases it consists of a cyst, produced by expansion of the duct, and condensation of the surrounding parts ; containing perverted secretion of the cyst, and of the corresponding salivary gland (Lapage, Munich, Louis). Not unfrequently, however, there is good reason to believe that the cyst, if a dilatation of normal structure, is produced from occlusion and submucous dilatation of a mucous crypt (Fabricius, Dionis) ; and in other instances the cyst is apparently a new formation altogether—like cystic swellings elsewhere (Dupuytren, Breschet). When the swelling attains to such a size as to displace the tongue, impede its movements, and produce a bulging in the submaxillary region, serious inconvenience in mastication, deglutition, and articulation occurs ; indeed, the term *Ranula* has been applied on account of the croaking change of voice. The tumour, presenting a bluish translucency, is distinctly seen on elevating the apex of the tongue ; and by manipulation its cystic nature will at once be rendered evident.

Two modes of treatment are applicable, according to the nature of the disease ; restoration of the normal opening, or the making of an artificial substitute. In recent cases, the former method may perhaps succeed. The occluded original orifice is, when found, dilated by probes of suitable dimensions ; and the due degree of patency and calibre should be subsequently maintained, by the occasional passage of a bougie or probe for some time afterwards. In most cases, however, the orifice cannot be detected, and therefore an artificial opening should be made wherever the tumour is most prominent towards the mouth. This may be done by simple incision ; but it is usually better to clip away a portion of the mucous membrane and sac, by means of curved scissors, so as to secure, as far as possible, the patency of the aperture. The contents which readily escape through even a small aperture, are usually of a gummy or albuminous character, and contain simple round mucous globules as their only structural element. To prevent premature closing of the aperture made into the cyst, it may be necessary to touch the margins as well as the interior of the sac occasionally with potassa fusca ; while others recommend, as soon as bleeding has ceased from the incision, that the cavity should be filled with lint, soaked in turpentine or some other irritating substance. This object, however, may be obtained in most cases by the mere introduction of a strip of lint. Some surgeons prefer the employment of a seton passed through the cyst, and retained until the requisite contraction is obtained. By others, a piece of silver wire—retained by twisting the ends—is recommended as more suitable than the seton ; and some resort to the ingenious expedient of introducing one button of a metal stud into the sac, with a perforation in its stem through which the contents may escape as they are secreted—the button itself resting smoothly beneath the side of the tongue.

Tumours beneath the Tongue.

Encysted tumours are not unfrequently found in this situation simulating the symptoms of ranula very closely. The cyst is thin ; the contents are yellowish, resembling tallow or lard, or may be of a pulaceous consistence. Sometimes they attain to a considerable size. When

manipulated they possess the elasticity of fluid combined with the doughy characters of a fatty tumour, which condition they very closely resemble. If the cyst lies beneath the mucous membrane, the sac should be opened towards the buccal cavity by a free incision, and the contents extruded by pressure ; and if the sac bulges more in the submaxillary region, its removal should be undertaken by dissection from below the jaw, taking care to avoid opening the cyst ; for, should this occur, the complete extirpation of the tumour will be extremely difficult.

Fatty tumours beneath the tongue simulate ranula so closely as to be with difficulty distinguished from it. The incision of the mucous membrane requisite for the treatment of either condition will solve the doubt ; and by a suitable extension of the incisions in the floor of the mouth, the delicate and loose attachments will easily be separated so as to effect complete extirpation.

Venous Nævus sometimes occurs in this situation, and may readily be mistaken for ranula. If a puncture has been made into its structure, the copious hemorrhage which ensues should be arrested by carrying a double ligature through the textures in the floor of the mouth by means of a curved sewing-needle, so as to secure the wound within the circuit of the ligatures when tied separately. In one case of this kind the puncture was secured by including it in the grasp of a pair of artery forceps, and surrounding it with a ligature.

Salivary Concretions.

Calcareous concretions, composed of phosphate of lime agglutinated with a small quantity of animal matter, sometimes form in the extremities of the ducts, both of the parotid and of the submaxillary glands, but more frequently in connection with the latter ; they are usually oval in form, of a yellowish-white colour, and granulated surface, varying in size from that of a pin-head to that of a large filbert. When small they rarely occasion much inconvenience, but are liable, especially when they obstruct the flow of saliva, to excite irritation both in and around the duct, attended with pain, swelling, thickening of the textures, and at times the formation of matter, both within and external to the canal. The accumulation of muco-purulent fluid in the submaxillary duct, obstructed by the calculus, may give rise to the formation of a ranula ; in the parotid duct, to symptoms which may readily lead the patient and practitioner to suspect the existence of gum-boil, or abscess of the antrum ; or, in milder cases, the uneasiness may be attributed to toothache, or facial rheumatism, or neuralgia. By manipulation, and use of the probe introduced along the duct, the presence of the concretion can, in most cases, be very readily detected. When of large size, they may become fully exposed, working their own way out by ulceration. The operation for removal consists in making a suitable incision, through which the calculus is laid hold of by forceps and extracted. But when the foreign body is small in a large containing cavity, it may retreat, and elude the attempt at seizure. In such a case,



Fig. 290.

Fig. 290. Salivary calculus, of considerable size, removed by operation.

the mastication of food, by producing a flow of saliva, will either wash away the concretion, or bring it within reach of the forceps. Cases have occurred in which the concretion has formed actually in the substance of the submaxillary gland.

The operation of *Glossotomy* was at one time extensively canvassed as a means of curing stammering. As first executed by Dieffenbach in 1841, it consisted in deep and extensive incisions through the muscles at the base of the tongue. After him Baudens, Amussat, Phillips, Bonnet, etc., recommended a division of the genio-hyoglossi muscles at a point more or less close to their attachments to the lower jaw. Velpeau even recommended the excision of a V-shaped portion of the extremity of the tongue. Experience, however, has proved that although attended by temporary improvement, no real good was to be gained by such proceedings.

CHAPTER XLII.

AFFECTIONS OF THE UVULA AND TONSILS.

Œdema of the Uvula.

ŒDEMA of the uvula, with a relaxed state of the neighbouring soft palate, may occur singly ; but more frequently it is the result of an imperfectly resolved inflammatory affection of the whole fauces. There is a feeling of very considerable discomfort in the part ; the quality of the voice is altered ; articulation is impeded ; and not unfrequently a tickling and annoying cough exists. The various astringent gargles are of service ; with attention to the general system. Failing these, stimulants and astringents may be applied directly to the part, in solution or in powder ; as alum, capsicum, tannin, etc. Or the part may be touched occasionally with the nitrate of silver, or sulphate of copper, in substance or solution. In obstinate cases, it is well that scarification precede the last-named remedies.

Elongation of the Uvula.

Relaxation of the uvula, with elongation, is of no unfrequent occurrence ; the extremity of the organ passing downwards, and by titillation of the glottis and pharynx, causing a very unpleasant and sometimes distressing cough, with a feeling of nausea and even retching. Sometimes the extremity is œdematous and bulbous ; sometimes it is thin and fimbriated. In the slighter cases, ordinary astringents and stimulants may be tried. But when elongation is considerable, as regards both extent and duration, there is no suitable remedy but by cutting off the redundant part ; an operation which has never yet been followed by any unfavorable consequences. The patient, seated before a good light, is directed to cough, so as to bring the pendulous uvula on the dorsum of the tongue. Then a suitable portion may be at once cut off by the stroke of sharp cutting scissors—probe-pointed, lest the patient should prove unsteady. Or—better—by a volsella or artery forceps the apex is laid hold of ; and then, by stretching the part, section will be facilitated as well as rendered more accurate ; care being taken not to stretch until at the instant of cutting, otherwise troublesome retching is apt to ensue. Complete extirpation of the uvula has been recommended in such cases, on the plea that relapse is otherwise probable. But, even supposing the plea to be justly founded, such a ruthless proceeding is scarcely warrantable ; the organ being doubtless endowed with some useful function to the general economy.

Tonsillitis or Cynanche Tonsillar.

This term denotes an inflammatory affection of the fauces, chiefly resident in and around the tonsils, affecting one or both sides; sometimes extending up the Eustachian tube and implicating the middle ear; ordinarily the result of cold due to atmospheric exposure, occurring most frequently in spring and autumn, particularly the former, and in the young and adolescent rather than in the adult or elderly. Sometimes it has a local cause for its origin, as the process of dentition in the inferior posterior molars, the swallowing of very hot or cold bodies, injury inflicted by the accidental swallowing of foreign bodies or caustics; also long continued crying, singing, public speaking, or playing on wind instruments, may all act as causes of this affection. It is characterized by swelling, redness, heat, and dryness, with pain of the part, impeded and painful deglutition, inability to separate the jaws, difficult articulation, marked alteration of the voice, and the ordinary constitutional accompaniments according to the intensity and advancement of the process. Commencing in inflammatory symptoms, very much alike, the results vary. In some cases, an erythematous blush, with more or less swelling, continues for a time, and then subsides; or, involving the substance of the gland, it terminates in suppuration; or a tardy resolution occurs, or the affection may prove formidable by assuming the truly erysipelatous type, and spreading downwards into the air passages. In others, so-called pustules or follicular abscesses appear, and terminate in the formation of yellowish ulcerated surfaces; in others, from the very first, a white milky pellicle coats the surface, a sure indication of the presence of that deadly malady Diphtheria. In the first, cold with more or less stomachic or hepatic derangement, constitutes all the cause; in the second, a rheumatic or gouty habit of body is generally found to co-exist; while in the third, a mephitic condition due to an insalubrious season, site, or drainage, is generally combined with an enfeebled constitution, predisposing and exciting to the typhoid symptoms and results which tend to occur, and which, rather than the local disease, determine the fatal issue. In these last mentioned cases, when recovery occurs, paralytic affections often make their appearance during convalescence, implicating singly, in combination, or in succession, the muscles of the soft palate, fauces, and extremities, as also the adaptive apparatus of the eyeball, and, according to some, even affecting the heart.

Treatment of cynanche is by ordinary antiphlogistics, local as general; purgatives being particularly efficacious. Scarification of the part is sometimes advisable, with the view of abstracting blood, controlling swelling, and rendering suppuration less likely to supervene. Leeching and blistering are rarely required; usually, a mustard poultice to the throat, followed by a large warm and soft cataplasm, or watery dressing, and hot water as a gargle, with Mindererus' internally, is the treatment necessary. In gouty and rheumatic cases, large doses of guaiac—half a drachm of the powder, thrice daily—have a resolute and almost specific influence; Dover's powder, too, is often useful in a similar way; relieving pain, and soothing to sleep. In the simple case the application of nitrate of silver only aggravates the symptoms, and

employed at the very first. In the pustulous and ulcerative, it will be found very advantageous. In the diphtheritic cases, chlorine, as a local application, and administered internally, with chlorate of potash, iron, nutriment, and latterly stimulants, are required.

Abscess of the Tonsil.

An acute abscess, of some size, in the tonsil, requires active surgical interference. If allowed to follow its own course, much distress is likely to be occasioned by pain and swelling, ere evacuation and subsidence take place; indeed, the swelling may be such as not only to prevent deglutition wholly, but also to impede respiration and threaten asphyxia. Besides, spontaneous bursting of the abscess may take place during sleep; and a considerable quantity of pus and blood, passing suddenly and unexpectedly into the glottis, may induce spasmodic dyspnoea of the most formidable character, not improbably suffocating the patient. To avert such results, the general principles of surgery should be fully carried out; by artificially evacuating the pus, so soon as it has been formed. This may be readily and safely effected thus:—The patient, placed before a strong light, is exhorted to great steadiness. With the fore-finger of the left hand the tongue is depressed, and the mouth opened so as to expose the red and prominent tonsil—perhaps already occupying the middle of the fauces, and displacing the uvula, the ordinary occupant of that space. A straight sharp-pointed bistoury, with its back resting on the tongue, is passed into the mouth and entered into the centre of the swelling, with the point directed straight backwards, as if with the intention of impinging upon the anterior surface of the cervical vertebræ—and not further out than a line corresponding to the inner side of the second molar in the lower jaw. A puncture having thus been made, a sufficient aperture is then established by moving the instrument towards the middle line with a slight sawing motion. The pus escapes upon the tongue, and is discharged externally. The edge and point of the knife should never be carried outwards and backwards; otherwise important blood-vessels are in danger—the internal carotid artery and the internal jugular vein posteriorly, and the common trunk of the temporal and internal maxillary arteries on the external aspect, being closely related to the tonsil.

A chronic stage is not unfrequent, in which the tonsil remains swoln, painful; and stationary; affording no sign either of recession by resolution, or of advancement by suppuration. Such uncertainty is best dispelled—and usually at once—by the application of a blister beneath the angle of the jaw.

It is of use to remember, that a patient once affected by tonsillary abscess is extremely liable to return of the affection, on the application of comparatively slight causes, until the first period of adult age has passed; and then the attacks become less frequent and severe, at length altogether disappearing.

In some cases in children, tonsillar abscess is accompanied with suppuration of the neighbouring parts of the neck, behind and below the angle of the jaw. In one such case, in a child about nine months old,

on opening the abscess of the tonsil behind the angle of the jaw, the finger passed readily from the external incision into the pharynx. For some days milk and other aliments escaped by the fistulous aperture thus established ; but as the opening gradually contracted this escape ceased, and the parts cicatrized soundly and quickly.

Ulcers of the Tonsils.

The tonsils are liable to ulceration from ordinary causes ; acute in character, from exposure to cold or wet, from the irritation of decayed teeth, or from tonsillitis excited by the “cutting” of the last grinders. Treatment is by touching the part occasionally with nitrate of silver, after removal or mitigation of the cause—extraction of the decayed teeth, or scarification of the tense gum over the molars.

Ulcers of the tonsils are, however, more usually chronic, and are then of constitutional origin ; connected usually with syphilitic taint of system ; sometimes of secondary, sometimes of tertiary accession ; the local characters of the sore varying according to circumstances—simple, weak, indolent, irritable, inflamed, sloughing, or phagedænic. Treatment, in such cases, is mainly constitutional ; consisting in the administration of alteratives, mercurials, iodine and its compounds, and arsenic, with lime-water and bitter infusions. To the part, nitrate of silver, or sulphate of copper, in the slighter or more superficial forms, will usually suffice ; while nitric acid will be needed in the deeper and more destructive affections.

Sloughing of the Tonsil.

Sloughing sometimes follows the acute tonsillitis, which forms a part of the scarlatinous, the putrid, and the diphtheritic forms of sore throat. When this stage of any of these forms of disease has been attained, little can be done either locally or constitutionally for the patient. Chlorine water as a lotion, Condyl's fluid, diluted, as a gargle—with iron, stimulants, opiates, and beef-tea, are alone likely to prove advantageous. In the earlier stage of acute tension, which usually precedes such sloughing, it has been proposed to make several incisions through each gland with the view of relieving the tension, which apparently, to some extent, determines the sloughing. A similar treatment by incision has also been recommended for the external lymphatic engorgement, which usually accompanies the latter stages of these malignant forms of tonsillitis.*

Hypertrophy of the Tonsils.

In adolescents of weak habit, chronic enlargement of the tonsils is very apt to occur, connected with a minor inflammatory affection of the fauces ; the swollen part partially and slowly subsiding between the inflammatory attacks, which are of frequent occurrence and induced by slight causes. In such cases it is not uncommon for the tonsils to become permanently enlarged, by simple hypertrophy. Both are, in general, affected ; projecting, as fleshy eminences, into the fauces ; interfering

* Geo. Hamilton on Scarlatina, Edin. Med. Journal, 1833.

considerably with deglutition, somewhat with respiration, and greatly with articulation ; producing a guttural tone of voice, which is very characteristic ; and always attended with loud snoring at night. The affection further often causes deafness, not generally by pressure on the Eustachian tubes, to which this symptom has very usually been attributed, but by a similar chronic engorgement of the mucous membrane of the canal. The patient, as might be expected, is very liable to acute inflammatory affections of the fauces, on the slightest exposure to atmospheric inclemency or vicissitude ; and then the amount of swelling which takes place usually, for the time being, occludes the fauces, and may even produce serious impediment to the entrance of air into the larynx. The sound produced is, however, in such cases, characteristically different from the laryngeal stridor which accompanies croup or laryngitis.

In the stage of excitement, unless respiration is seriously impeded, it is best to calm down the irritation by the use of mild antiphlogistics for a few days, with low diet, aperients, gentle diaphoretics, sinapisms, or other light counter-irritation. In the indolent state in very young children, it is our object to amend the general health by a tonic system of general treatment ; thus seeking to obtain gradual subsidence of the swellings by discussion. Should this fail—and in the adolescent, where the condition is of long standing—we may proceed at once to remove the redundant texture. As discutients, nitrate of silver, alum, iodide of zinc, and perchloride of iron, are most in use ; the two first rubbed on the parts in substance, the two last applied in strong solution, by means of a hair pencil or a piece of sponge. The constitutional treatment is as for the strumous cachexy—a condition very similar to, if not identical with, the state of system found to prevail in such patients. In removing the tonsils, our object is not to extirpate the glands, but merely to slice off the redundant portions which project beyond the arches of the palate. The mouth being opened before a good light, the prominence of the swelling is seized firmly by a volsella ; and while by means of this instrument the gland is made tense and steady, by being drawn towards the middle line, a curved probe-pointed bistoury is passed into the mouth, and carried over the upper margin of the gland close to the pillar of the fauces. Its edge having been brought in contact with the upper part of the base of the swelling, the section is made downwards by a slight sawing motion ; and if the incision is made parallel to and along the margin of the palato-glossus, there need be no anxiety on the score of hemorrhage. Some recommend the tonsil to be removed by cutting from below upwards, lest the tongue should sustain injury ; but as by this method the palate is more likely to be cut, and as in most cases the upper margin of the enlarged gland is rounded, tuberos, and defined, while the lower extends like a tail between the palato-glossus and pharyngeus, it is obvious that this latter portion, if hypertrophied, can only be satisfactorily dealt with by making the incision as first recommended. Having removed one gland, a similar procedure is repeated on the opposite side. Bleeding and pain are generally inconsiderable. The raw surfaces granulate and heal without any treatment ; occasional application of the nitrate of silver being made lightly, if the process prove tardy. It is seldom that reproduction is even threatened.

It is sometimes a difficult matter to effect this little operation satisfactorily upon a struggling and crying child. In such circumstances chloroform should be administered ;

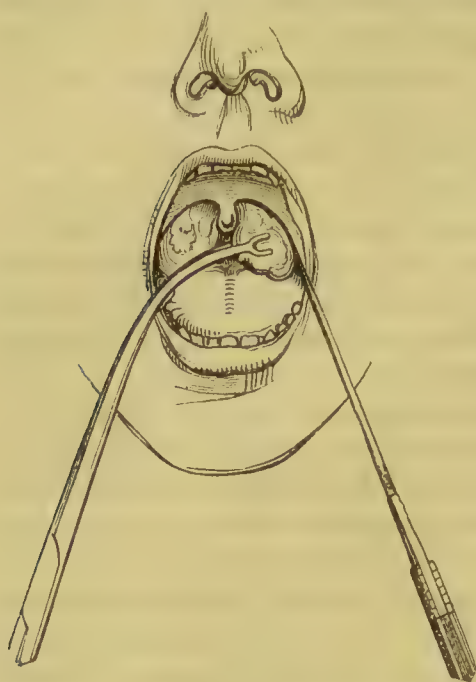


Fig. 291.

when, keeping the mouth open, and the tongue depressed by means of a spatula held by an assistant, the requisite manœuvres can easily be effected in a very few seconds. Or the mouth being forcibly opened, and the child held still, the tonsil-guillotine may be used ; an ingenious instrument adapted for at once fixing and removing the protruding part. The bistoury, however, and the hook-forceps—dating back as far as the time of Celsus—have this twofold advantage, that the instruments are the simplest possible and always at hand. Scissors, although they might seem better suited to the removal of such parts, are rarely capable of effecting the

complete division with a single stroke. In one instance, where a pair of double-action scissors were employed, not only was the section incomplete, but the scissors and the tonsil had to be removed together by completing the operation with the bistoury. Ligature of the glandular projection has also been recommended, but it is difficult to understand how it could ever have been effected.

Objections have been taken to such operations, on the ground that dryness of the fauces is apt to follow, with imperfect articulation ; and that sometimes also there has seemed to be a certain amount of sexual impotence induced. The experience of most surgeons does not tend to sustain such allegations ; at the same time there is no doubt that most cases of chronic enlargement of the tonsil, in adolescents, can be got rid of by local discutients and constitutional alteratives, and that therefore operative interference should not be urged upon the friends of patients, unless a fair trial of milder measures has failed ; or unless the enlargements are so great as to meet midway ; or unless the patient's general health is suffering from the long-continued faucial irritation ; or unless the guttural tone of the patient's voice, his deafness, or the snoring at night, interfere seriously with his comfort, or make him a nuisance to his family or associates.

In all cases of secondary syphilitic enlargements of the tonsils, a similar ablation of the projecting portion of both glands will be found very materially to hasten the restoration of the throat to its healthy condition.

Fig. 291. Excision of the tonsils.

Aneurism in the Situation of the Tonsil.

The internal carotid artery, where it lies behind the tonsil, may become the site of an aneurismal development, and the sac may project towards the pharynx. In such circumstances it is liable to be mistaken for an abscess. An example of this disease occurred under the care of Mr. Syme in 1842,* in a lady about sixty years of age. The tumour had existed for six months, and during that period had gradually increased in size so as to occupy the fauces and interfere with deglutition. The common carotid was tied below the crossing of the omohyoid, but the patient dying from an intercurrent attack of diarrhoea, an opportunity was afforded for the examination of the disease. The aneurism was found to occupy the internal carotid from its junction with the common trunk, to just below its entrance into the carotid canal; the aperture of communication corresponded to the middle of the vessel, was half an inch in length, and was a crevice through the inner coats of the artery. The sac was formed of the outer coat, which was so dilated as to give to the course of the vessel a sigmoid direction. The contents of the sac were coagulated, except in a narrow channel corresponding with the current through the artery.

Malignant Disease of the Tonsils.

Cancerous ulceration may extend to the tonsil from the tongue; or may originate in the gland itself. The latter event is rare.

Carcinomatous or medullary tumour may occupy the tonsil, as a primary disease; but more frequently such enlargement of this part is but an extension of malignant disease from the lip or lymphatic gland.

All such affections are incurable; and operative interference is out of the question—unless, indeed, at an advanced period of the case temporary relief by bronchotomy be deemed advisable, on account of impending asphyxia.

* Contributions to the Pathology and Practice of Surgery, 1848.

CHAPTER XLIII.

AFFECTIONS OF THE PHARYNX AND ŒSOPHAGUS.

Pharyngitis and Œsophagitis.

THE inflammatory process, affecting the pharynx pre-eminently or solely, is of comparatively rare occurrence. As an accompanying part of the different forms of Cynanche, we have already had occasion to say all, as regards both symptoms and treatment, that seems requisite. As a separate malady, inflammatory affection of the pharynx or œsophagus most frequently is the result of a direct exciting cause ; as the lodgment of foreign bodies, or the contact of boiling fluids or of acrid substances, such as nitric or sulphuric acid, soap ley, or caustic alkalis, either in the solid or fluid form. The membrane, as far as can be seen through the mouth, becomes red and swoln, at first dry, afterwards affording an increased and perverted secretion ; deglutition is difficult and painful ; when the upper part of the œsophagus and pharynx are the parts affected, as is usually the case, pain is felt on manipulating the parts from without, and by movement of the larynx and trachea ; pain is also experienced in the nape of the neck, extending downwards towards the upper part of the thorax, and the ordinary constitutional symptoms attend. The expression of the patient's face becomes anxious, and when an effort at swallowing is made, the suffering is sometimes so intense that the features become spasmodically convulsed, as the bolus passes the affected part. The affection may simply resolve ; or ulceration may take place in the membrane, accompanied with purulent discharge ; or the submucous tissue may become the seat of abscess (pharyngeal or œsophageal) ; or by submucous plastic formation, and change of structure in the membrane itself, contraction of the pharyngeal space (stricture) may result.

Pharyngeal and Œsophageal Abscess.

When matter has formed beneath the mucous membrane, if the upper and posterior part of the canal is affected, a fluctuating yet tense swelling may be perceived ; and deglutition and respiration become more and more impeded, according to the increase of the tumour. In children the affection is even apt to simulate croup.* Treatment is by early and free evacuation by incision, which may be made with perfect safety. If the abscess be large, it has been recommended to use a trocar and canula ; lest the pus, suddenly escaping in quantity, might endanger suffocation ;

* *Vide* Monthly Journal of Medical Science, August 1846, p. 146. *Ibid.*, October 1847, p. 220. Also, Abercrombie, Edin. Med. and Surg. Journal, April 1819.

all such risk can easily, however, be avoided by laying the infant in the prone position over the nurse's knee, so soon as the incision has been made. If opening be delayed, not only are risk and inconvenience great by the large size of the tumour; there is also the same danger from sudden spontaneous discharge, as in abscess of the tonsil; besides, the soft parts may become extensively undermined by burrowing of the matter; and, in the ultimate cicatrization of a large cavity, contraction and stricture of the pharynx may result. When abscess forms lower down, the situation is usually either at the upper part of the œsophagus, or immediately above the diaphragm; these being the situations where spicular foreign bodies are most apt to lodge, and, by puncture of the mucous membrane, to set up suppuration in the parts around. In the former situation, more or less diffuse swelling of the neck will usually indicate what is taking place, while rigors generally accompany the formation of matter. In some instances the abscess opens into the œsophagus or pharynx—as is indicated by a copious discharge of pus tinged with blood. In other cases it burrows along the pharynx and œsophagus beneath the deep fascia of the neck, and unless evacuated, may give rise to very serious results by undermining the trachea, œsophagus, and the blood-vessels; or it may even extend into the mediastinum. Sometimes, again, it points acutely towards the surface; or, after a long period of suffering and hectic, openings may form in different parts of the surface of the neck, and a communication become established between the pharynx or œsophagus and the cutaneous surface—constituting a fistula. Whenever, by local or constitutional symptoms, we apprehend that an abscess is forming in this situation, especially if it be due to the lodgment of a foreign body, we should not wait till the abscess points, but establish for it a free opening towards the surface. This, according to its situation, may be made either behind or in front of the great vessels. In the former case, an incision should be made upon the anterior aspect of the transverse processes and bodies of the vertebræ, from behind the margin of the sterno-mastoid muscle; after opening the deep fascia, the finger is used to push the vessels forwards out of the way; and then the collection of matter is safely reached. In the latter case, an incision should be made along the anterior margin of the sterno-mastoid, as for œsophagotomy or ligature of the carotid; and after dividing the sterno-hyoid and thyroid muscles, the finger is again used as a guide in completing the evacuating wound. When, again, the abscess in connection with the œsophagus forms in the posterior mediastinum, it may evacuate itself into the canal; this, however, will in all probability only afford temporary relief, as each act of deglutition is likely to be attended by the escape of some portion of the fluid or solid food into the sac. This will be followed by putrescence, further extension of the abscess, the occurrence of pleurisy, or even of a localized pneumonia in the neighbourhood of the abscess, and the supervention of pyæmia. In some few cases the abscess has made its way to the surface, and effected its evacuation by the side of the sternum, between the lower costal cartilages. Such cases rarely admit of any operative interference. Could we be absolutely certain of the existence of such communication between the abscess and the œsophagus, the risk of extravasation of articles of food

into the abscess-sac might be avoided, by passing the feeding-tube from time to time, or by maintaining life by nutrient enemata ; thus, as far as possible, leaving the œsophagus and stomach in a state of perfect repose. But the diagnosis of such a condition is seldom more than a mere suspicion. When the abscess opens upon the surface as already described, and if the matter has not a sufficiently free vent, the removal of a portion of the sternum with the trephine, or of the cartilage of the ribs by the bone-pliers, may be resorted to.

Stricture of the Pharynx and Œsophagus.

Constriction of the gullet may be due to permanent structural change, to extensive compression of the canal, or to temporary spasm of its muscular structures. The permanent structural change may either be *simple* or *carcinomatous* in its nature.

(1.) *Simple* stricture may be the result of inflammatory structural change in the mucous membrane, with accumulation of plastic material in the submucous tissue ; and on the latter occurrence the contraction mainly depends. Or it may be the consequence of ulceration of the membrane, with or without suppuration in the parts beneath, caused by the accidental swallowing of caustics, boiling water, etc., or by specific affections, as in some cases of tertiary syphilis. The prominent and characteristic symptom is difficulty of swallowing, more especially of solid and imperfectly masticated food ; the patient complains of the food becoming either partially or completely arrested, and in the instance of the constriction occupying the upper part of the canal, its arrest may be recognized by the finger of the surgeon. The difficulty in deglutition as it increases, which it usually does slowly and insidiously, leads the patient to masticate the food more and more carefully, while the pain shooting into the back of the neck and shoulders, produced by the portions of food passing the constricted part, communicates such an appearance of anguish to the countenance of the patient, will seldom fail to arrest the attention of the practitioner, especially when coupled with the history of the case, the site of uneasiness and obstruction, and the emaciation which soon becomes established. But as these symptoms may be simulated either intentionally or from the existence of hysteria, it is well to determine with certainty the existence of the change, by the use of a probang or gum-elastic bougie, whose passage downwards is resisted or arrested by the contracted part. The ordinary site of contraction in simple stricture is at that part of the canal which is naturally most narrow—the junction of the pharynx and œsophagus.

(2.) *Malignant* contraction is produced by carcinomatous formation either commencing in, or secondarily involving the mucous and submucous tissues ; the surface speedily assumes the open condition, and is then attended with a copious muco-purulent and bloody discharge. This affection may occur in any portion of the canal ; but the upper part of the œsophagus, and immediately above the cardiac extremity of the stomach, are the most common sites. When situated within the thorax, the diagnosis of stricture, from obstruction afforded by extrinsic aneurismal pressure, must be carefully made out. When the malignant disease occupies

the upper part of the œsophagus, its presence can usually be detected by examination of the parts, with the fingers pressed deeply towards the vertebrae in the hollow of the anterior triangle of the neck, while the patient's head is bent forwards. The symptoms are, great pain in the affected part, aggravated by deglutition and pressure, great and increasing difficulty in swallowing, with the expectoration of foetid, copious, bloody discharge; as the affection advances, gradual wasting of the frame, partly by inanition, partly by progress of the malignant cachexy. When the stricture is situated low down, if the saliva has been swallowed, or the patient takes a drink of water, or swallows morsel after morsel of food, gradual accumulation takes place; and when the gullet can contain no more, the whole that has been swallowed becomes again ejected, not with any violent effort at retching, but by a gradual peristaltic action, which only ceases when the whole has been discharged.

When the stricture is tight, and of considerable duration, the tube usually becomes dilated above the constricted part, forming a pouch in which food accumulates; while from increased functional effort the constrictors of the pharynx become hypertrophied, and the upper cornua of the thyroid cartilage closely approximated.* Above the stricture, too, ulceration is apt to take place; which, though not necessarily malignant, is nevertheless in simple cases very intractable, and most inconveniently complicates the case. Stricture of the œsophagus is apt to be simulated by cancerous affections of the stomach about its cardiac orifice, but can be distinguished by the latter affection being accompanied with true vomiting—not mere peristaltic expulsion—and by the ease with which a full-sized œsophagus bougie can be passed into the stomach without arrest.

(3.) *Extrinsic Compression of the Œsophagus as a cause of Constriction.*—In the examination of cases of constriction of the œsophagus occurring within the upper thoracic portion of the canal, its relation to the arch of the aorta should be kept in view as a possible cause of the symptoms of obstruction, both to deglutition and to the passage of instruments. For the careless introduction of a probang or bougie might, with very little force, rupture the thin partition which separates the canal from the sac of the aneurism, and thus induce rapidly fatal results.

The simple stricture is treated by dilatation; and this should be resorted to as soon as possible, so as to prevent the induction of an approach to inanition, or the occurrence of dilatation and ulceration of the gullet above the seat of stricture. A probang—a rounded piece of whale-

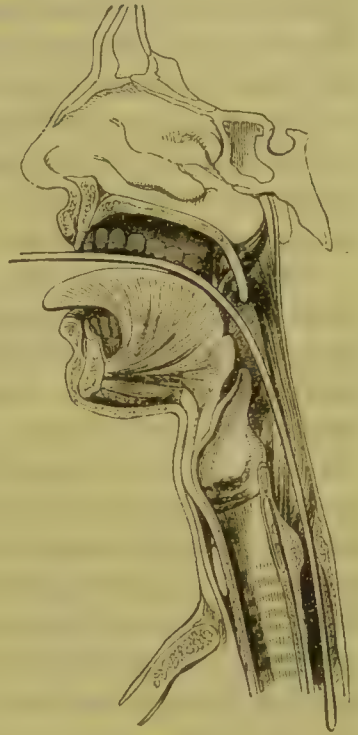


Fig. 292.

* Lancet, No. 1209, p. 483.

bone, with a bulbous extremity made of ivory—well oiled, is passed gently down to the obstruction ; or a gum-elastic bougie may be used for the same purpose. One having been selected of such a size as will pass without the use of force, it is lodged in the contracted part, and retained there for some time—according to the sensations of the patient. After a day or two, the irritation caused by the former instrument having subsided, another, a size larger, is similarly employed. And thus, gradually, the normal calibre is restored. An instrument of full size should be passed occasionally, however, for some time afterwards, to obviate the tendency to recontraction which exists in all mucous canals so affected. The object of the passing of instruments is, not to excite inflammatory softening or ulceration in the contracted part ; for this would plainly tend to ultimate aggravation of the morbid state ; but to excite absorption of the submucous product, and a resolutive process, with discharge, in the membrane itself. At the same time, some benefit is also obtained by mechanical dilatation.

When the stricture is situated below the level of the sternum, even more gentleness and care, if possible, are expedient in using the bougie than in the case of stricture of the pharynx, or of the cervical portion of the œsophagus ; force being more likely to produce lesion of the membrane, and even to cause perforation of the tube. It has happened that the head of a probang, supposed to have passed on to the stomach after having overcome the stricture, has been found, after death—at no distant date, and not unconnected with the event—to have lodged in the mediastinum ! Another precaution is equally necessary in thoracic constriction ; namely, to beware that there is no error in our diagnosis ; to be certain that the contraction is really caused by structural change in the œsophagus itself, and not dependent on the pressure of an aneurismal or other tumour.

The malignant stricture admits only of palliation. Great attention is paid to the administration of nutritive and easily swallowed ingesta, so as to husband the failing strength ; while pain and discomfort are assuaged by opiates. After effecting our diagnosis, direct interference with the part, by means of bougies, caustic, or otherwise, with dilatation in view, cannot but do harm. Often, however, the pain of the ulcerated surface may be relieved, by occasionally touching it with a solution of the nitrate of silver. The passage and permanent retention of a nasal feeding tube has been recommended in these cases, ere the diminution of the calibre of the gullet has become so great as to prevent this being carried into effect. While in others, where the occlusion is complete, and threatened inanition imminent, *œsophagotomy* or *gastrostomy*, according to the site of constriction, has been recommended as a means of prolonging a miserable existence.

(4.) *Spasm of the Pharynx and Œsophagus*.—In young and middle-aged patients of nervous temperament, prone to hysteria, with stomach and bowels disordered, spasm of the muscles of the pharynx and œsophagus is not an unfrequent occurrence ; causing the *bolus hystericus*, pain in the part, with an uneasy and apprehensive feeling of tightness, and materially interfering with deglutition. The attacks are occasional, sudden in accession, and gradual in remission. The treatment is mainly

constitutional ; of an alterative, tonic, and antispasmodic character. Locally, external counter-irritation of a slight grade, or opiate friction, or a belladonna plaster over the nape of the neck, may be of service. Sometimes even the passing of the probang will not convince the hysterical patient that the affection is merely nervous.

Paralysis of the Pharynx and Œsophagus.

This, occurring in the sequel of any disease, is usually of very unfavourable import ; denoting affection of the brain, probably by effusion, which is likely to prove fatal. It may occur singly, however ; as after external injury of the head or neck ; and then the prognosis may be somewhat more hopeful. The prominent symptom is simple dysphagia, which, although complete, is not attended by obstruction to the passage of instruments, or any other sign of stricture in the canal. Treatment is to be directed mainly to the head and neck, by counter-irritation and such internal remedies as may seem advisable ; while life is meanwhile sustained by supplying the patient with nutritious fluids, by means of a tube passed into the stomach. Galvanism and the use of strychnine are only to be employed when there is no indication of any advance in the process of cure.

Sacculated Pharynx.

Sometimes the lower part of the pharynx becomes dilated into a pouch, of greater or less size, situate immediately behind the œsophageal orifice. Food lodges there, sometimes for many hours, coming up again in a kind of rumination. Deglutition is difficult and imperfect ; often accompanied, especially when liquids are taken, with a churning noise. Frequently, too, there is a copious secretion of glairy mucus ; sometimes accumulating spontaneously in the mouth, more commonly brought up by hawking. The affection plainly admits of no direct treatment ; and care must be taken in using the probang—should that be thought necessary for an exact diagnosis, or employed in the belief that the case is one of tight stricture—lest it should enter the pouch, and be forced thence through the parietes.

Tumours of the Pharynx and Œsophagus.

Tumours occasionally, though rarely, form in the pharynx. They occasion dysphagia proportioned to their bulk. They may be simple, and of the polypous character ; and these may be removed by forceps, if within reach. The double canula and ligature have been spoken of as means suited for their removal—obviously, however, quite inapplicable unless their root be within reach or sight ; and then forceps would far more certainly and satisfactorily secure the same end. More commonly the tumour is medullary ; and then irremediable.

Foreign Bodies in the Pharynx and Œsophagus.

Articles of food, or any other substance which admits of being taken

into the mouth, may be swallowed either intentionally or accidentally, and from their size or form, or from a combination of both peculiarities may become arrested in their passage downwards; even when no abnormal contraction exists at any part of the canal. Substances of some size and solidity, if they pass into the bag of the pharynx, are likely to rest at the narrowest part of the gullet, viz., the lowest part of the pharynx or upper part of the œsophagus—a little above or nearly opposite the cricoid cartilage. Those of a slim and spicular character, on the contrary—as needles, pins, fish bones, etc.—are more frequently entangled in the folds of the soft palate. Those foreign bodies, again, which produce an impediment, partly by size, partly by their spicular form, if not arrested at the upper part of the œsophagus, may pass onwards, and be stopped immediately above the diaphragm. While this is generally true, even bodies of large size may either spontaneously, or by the efforts of those who have attempted to render assistance to the patient, become displaced, and be secondarily arrested at the lower part of the canal. The symptoms present are general—to all cases; and special, depending upon the form and size of the foreign body and the site it occupies. The patient complains that while eating he consciously swallowed the substance, which he felt arrested at a certain point; or while playing with, or holding in his mouth, or attempting to swallow for concealment or a wager, or as a juggling trick, some known body, it became arrested in the passage. He can usually point to the spot, complaining of a constant localized pain there, and of increased suffering whenever he attempts to swallow. The effort to swallow may be efficient, and attended with convulsive contraction of the muscles of the face and neck when the bolus of food or mouthful of fluid passes the site of the obstruction; or it may be ineffective, and followed by efforts at vomiting of a violent and convulsive kind. When the foreign body is large, and occupies the upper part of the pharynx, suffocation is induced either from direct compression of the larynx, or by reflex irritation and spasm of its muscles. Should the foreign body occupy the upper part of the œsophagus, the direct compression of the trachea which it produces may be attended with more or less urgent difficulty of breathing, but not so great as in the instance of a foreign body in the upper part of the pharynx. Smaller and irregularly-shaped bodies, arrested lower down, do not usually interfere with respiration, neither do they altogether interrupt deglutition, but usually admit of the swallowing of fluids and soft pappy food. These pointed and irregular bodies are, however, attended by more serious risks than any other;—wounding the canal, inciting ulceration and perforation of its walls, followed by extrusion into surrounding parts, and the formation of diffuse suppuration in the neighbouring textures, and all its attendant evils, or even by fatal hemorrhage, should any vessel of importance be implicated in the ulceration. When the foreign matter is lodged in the pharynx, it is within reach of the finger; and this is the best instrument by which to ascertain the exact site and nature of the lodgment—as well as the best guide to the forceps in extraction. Even a minute substance entangled in the fauces causes much discomfort; and besides if not removed, will probably induce a certain amount of the inflammatory process. But the larger and solid substances, lodged lower down

call more urgently for our aid ; inasmuch as, unless removed forthwith, they threaten suffocation.

The patient is seated firmly on a chair ; the fore-finger is thrust determinedly into the fauces over the posterior molar teeth ; and its point is moved about in every direction, until either the foreign substance is discovered, or the surgeon is satisfied that there is no foreign body there. Much retching will be occasioned, in all probability, by which the foreign body may be dislodged and ejected ; but should this not occur, these efforts must be unheeded by the examiner, and endured by the patient ; perquisition of the soft palate being got over as speedily as possible, the extremities of the nerves concerned in the production of vomiting being chiefly situated there. The presence and site of the impacted foreign body having been ascertained, it is seized by forceps, and gently withdrawn. For pins and small bones in the arches of the velum, the ordinary dressing forceps, or merely the finger-nail, will suffice. For solid matter lodged lower down, longer forceps, gently curved at the extremity, are more suitable.

When the foreign body is lodged in the œsophagus, its existence in the upper part of the canal, if bulky, may be recognised by manipulation of the parts from without. Should this afford no evidence, its presence and situation are ascertained by the use of the bougie, probang, or bent forceps—passed carefully down, and moved gently. According to the nature of the substance and its site, either extraction or propulsion is practised. Extraction, if practicable, should be in all cases considered the preferable procedure, whatever the nature of the foreign body. If, however, the obstructing body be a piece of meat, or other bulky article of food, not likely to injure the canal in a forced passage, and capable of being subsequently digested in the stomach, it is the usual practice, especially when the foreign substance is situated low down in the œsophagus, and beyond the reach of forceps, or when forceps are not at hand, to push it gently downwards by means of the probang. Though perfectly warrantable in such circumstances, and generally recommended when the foreign body can be displaced so easily, it is better, in the first place, to attempt to effect its dislodgment and ejection by exciting efforts at vomiting. This can easily be produced, should the patient be unable to swallow an emetic, by tickling the fauces ; and there is never the slightest propriety in resorting, for this purpose, to the use of tobacco enemata, or the injection of a solution of tartar emetic into the veins. When, however, the circumstances are of an opposite character—as usually happens ; when we are satisfied that the œsophagus cannot fail to sustain further injury by attempts at propulsion, and that the stomach will be unable to make any satisfactory impression on the substance, should it be received there, and when we have the necessary instruments at hand, extraction should certainly be preferred. Long, curved forceps are the suitable instrument. For this purpose two pair of forceps are usually recommended ; one—the more generally useful—opening laterally (Fig. 293) ; the other (Fig. 294), opening in an antero-posterior direction. If introduced over the molar teeth, those with the blades opening laterally (Fig. 293) will generally be found quite efficient in grasping a flat or narrow body, the axis of which is situated transversely across the canal.

Seizure having been made, dislodgment from the parietes of the canal is to be effected, by a cautious wriggling movement of the hand, before extractive power is applied ; to avoid slipping of the forceps, or unnecessary injury of the parts. Needles or pins may be entangled in loops of thread attached to the end of a piece of whalebone ; passed down to the site of lodgment, and moved gently about. Flat substances, such as

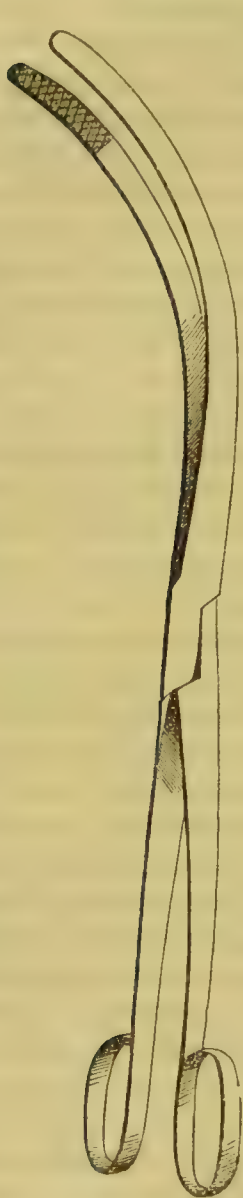


Fig. 293.

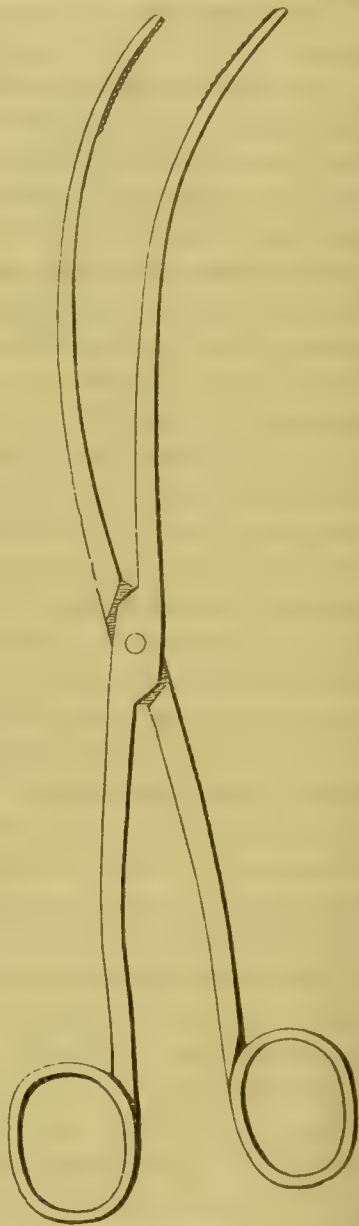


Fig. 294.

coins, presenting their edges to the operator, may be brought up by a flat and broad blunt hook. Even a considerable portion of bone has been removed in this manner* from the œsophagus ; and as such an instrument can easily be made extemporaneously out of a double piece of stout

* Stedman of Kinross, 1731. Medical Essays and Observations by a Society in Edinburgh, vol. i. art. 16.

Fig. 293. Forceps for extracting foreign bodies from the pharynx and œsophagus.
Fig. 294. The companion forceps to Fig. 293 ; opening in the opposite direction.

wire, its use may be resorted to when forceps are not at hand, or where the foreign body is beyond their reach.

When indigestible substances have passed into the stomach, they usually find their way to the surface, by the natural outlet—per anum; passing off with the feculent matter—often but little changed—after the lapse of some time, varying from days to even years. To assist the downward movement, purgatives are often recommended. If the foreign body be solid and obtuse, no harm may be done by their employment, and extrusion will probably be expedited. But if the substance is sharp and spiculated, the practice cannot but be mischievous; tending to produce entanglement in the mucous membrane, probably with perforation of the bowel; and also likely to kindle inflammatory access in the affected part. In such cases, therefore, it is more prudent to wait the working of Nature, administering to the patient such articles of food as are likely to afford a copious excrementitious result, so as to entangle and shield the foreign body in its passage; porridge, figs, and dried French plums being well adapted for this purpose. Needles may perforate the intestinal canal; but, if left to themselves, the process is gradual, and usually harmless. In due time the foreign body appears at the surface, perhaps months after the date of its entrance, and thence it should be removed by incision if required. In many cases, however, in which needles are alleged to have been swallowed, and to have appeared from time to time upon the surface in most extraordinary circumstances, they have in reality reached the situation they occupy by a much less circuitous route, having been directly and wilfully introduced into the part, to the extent of even hundreds. The reason for such tampering it is sometimes hard to discover; but the pleasure of having chloroform administered, the interest attaching to their case, the desire to secure the attention of a medical man, or an excuse for lying constantly in bed, have all been met with as the only apparent reason in a hysterical patient for such very extraordinary conduct.

Fish-bones, and bones of rabbits or other small animals, are not unfrequently arrested by the sphincter of the anus, after having safely made the passage above; and may require the use of both knife and forceps for their removal. Cherry-stones, and such like substances, may lodge in the vermiform process of the caput cæcum, and excite either abscess there, or general peritonitis.

Occasionally, though rarely, it happens that the foreign body will move neither up nor down in the œsophagus. Prudent efforts at extraction and propulsion having both failed, excision (œsophagotomy) is the only other resource. This, however, can only be resorted to when the foreign body is lodged in the pharynx or cervical part of the œsophagus, or at least not lower down than the upper thoracic portion of the canal. In other cases, instead of resorting to such force as may lacerate or rupture the canal, or of groping for it with ingenious contrivances from day to day, it is safer to leave the foreign body alone; trusting to the ulcerative process, which it is likely to induce by its pressure on the walls of the canal, as a means of effecting its dislodgment, and ejection by vomiting, or its passage downwards to the stomach. During this period, should the patient be able to swallow, milk only should be administered as

food ; or nutrient enemata may be resorted to, should the dysphagia be complete.

It must not be imagined, however, that foreign substances may be left without risk to loosen themselves by suppuration, and so to facilitate, if not effect, their own extrusion. The obstruction to deglutition, and impediment to breathing, are themselves circumstances sufficiently untoward to demand prompt interference. The inflammatory process, too, which is sure to follow, is fraught with both disadvantage and danger ; it may lay the foundation of a formidable organic stricture ; it may cause a troublesome abscess, resulting perhaps in a fistulous opening in the canal ; or, in a low site, ulceration may open into the arch of the aorta, and prove speedily fatal.

It is important to remember that very frequently the painful sensation of a foreign body lodged in the pharynx or œsophagus remains, for hours or even days, after the substance itself has been ejected, or has passed down into the stomach. When, therefore, we have made a careful examination of the parts, and satisfied ourselves that no foreign body is there, we treat such abnormal sensation by leeching, followed by counter-irritation, or by anodyne embrocation.

The passing of Instruments by the Pharynx and Œsophagus.

The surgeon is not unfrequently called upon to pass instruments into the pharynx and œsophagus ; curved forceps for the extraction of foreign bodies ; probangs and bougies for the propulsion of impacted articles of food, or for the relief of simple stricture ; hollow tubes for the conveyance of nourishment into the stomach, in cases of wound of the pharynx or œsophagus—as in cut throat ; and the tube of the stomach-pump, in cases of poisoning. The points to be attended to are ;—to use all gentleness, so as to avoid lesion of the lining membrane of the canal ; and to take especial care, particularly when it is our object to throw in ingesta, that the tube does not pass into the air passage. If the patient be sensible, he is seated on a chair, with the head thrown much back, so as to bring the upper part of the alimentary canal into as straight a line as possible. The mouth having been opened wide, and the tongue depressed with the left fore-finger, the tube is moved rapidly past the soft palate, so as to avoid retching ; and its extremity is then gently propelled, resting on the posterior part of the pharynx, and made to glide, as it were, on the anterior surfaces of the vertebræ in its passage downwards. When the instrument's point is opposite the rima glottidis, the patient may be directed to make an effort to swallow ; or, with the left hand, the surgeon may hook the root of the tongue and upper part of the larynx forward out of the way. As the tube passes into the œsophagus, a false sense of obstruction is sometimes produced by its coming in contact with the ring of the cricoid cartilage ; to overcome this, all that is required is to pull the box of the larynx and upper part of the trachea gently forward from the œsophagus ; such movement being plainly conducive to the free passage of the instrument into and down the canal. When insensibility exists, the operation is in one way facilitated ; inasmuch as there is no resistance on the part of the patient. But, in such cases, it is plain the

our care to insure a right passage for the instrument must be doubly exerted ; the patient having no power to warn us of a threatened deviation from the proper track. In most cases, the facility with which the tube has passed, the length which has been introduced, the sensation afforded by pressure of its extremity against the coats of the stomach, and the equable progress of respiration, will sufficiently indicate that the tube is in its right place. Should any doubt exist, it may be well to assure ourselves fully that the tube is in the œsophagus, and not in the larynx, before fluids are passed downwards to the stomach. For this purpose, a sheet of paper should be placed over the face, with the extremity of the tube projecting through it ; while in front of the tube a lighted taper is held, which by the paper is effectually screened from the flatus of the nostrils in expiration. If, on expiration, the flame remain steady, no air impinging on it, we may proceed with injection ; the tube is certainly in its right place. If the flame be extinguished, or even made to bend considerably, it is equally plain that an error has been made ; and that injection would almost certainly occasion fatal asphyxia. It should be remembered, however, that this test is sometimes misleading, the flame being deflected a little, although the tube be quite in its right track.

It is well also to remember, that in cases where no stricture exists, a large instrument is preferable to one of small size ; being much less likely to enter the windpipe. And it is also worthy of note, how, in emergencies, a syringe is not essential to effect clearance of the stomach ; a tube having been passed, the fluid contents of the stomach may be made to flow out by it, on merely inclining the body over the bedside so as to bring the mouth to a lower level than that of the epigastrium ; or a long tube may be employed as a syphon. In order to introduce fluid into the stomach, a common small tin funnel will be found satisfactorily to answer the purpose. When a syringe is employed, it should always be with caution ; otherwise, ecchymosis and laceration of the gastric mucous membrane are not improbable.

Also, unless previously aware that the stomach contains much fluid, it is prudent to begin the operation of “pumping” by injecting tepid water, which is afterwards pumped out along with the previous contents ; and this injecting and ejecting may be repeated as often as may seem necessary, with the double view of washing out the viscus thoroughly, and at the same time avoiding injury to the lining membrane.

Rupture and Laceration of the Pharynx or Œsophagus have occurred in consequence of violent efforts to extract or propel foreign bodies impacted in the canal ; also in attempts to pass the probang, bougie, or stomach-tube ; and one case is narrated by Boerhaave, where violent vomiting produced rupture of the œsophagus. Such injuries occurring in the neck, will probably occasion abscess or diffuse suppuration ; requiring relief by free incision. Within the thorax the result has generally proved rapidly fatal.

Œsophagotomy.

This operation is designed to effect the removal of foreign bodies from the lower part of the pharynx, and upper part of the œsophagus, when

by their presence life is endangered, or suppuration is threatened, and when they are so firmly impacted as to be unremovable by other means. Verduc in his Surgical Pathology was the first to broach the idea of this procedure; and although learnedly discussed by others, it was first practised by Goursauld, a surgeon in Limousin, in 1738. Since his time the operation has been occasionally resorted to by others; the infrequency of its performance being due, not to any objection to its validity as an operative procedure, but to the rarity of cases requiring its performance. When the foreign body forms a distinct prominence in the neck, its situation will form a guide in regard to the site of the incision and the further dissection. Cases, however, have occurred (Arnott, Syme) where no such prominence was appreciable either by sight or touch. In such circumstances, a flexible bougie should be passed before commencing, so as to determine by measurement externally the level at which the foreign body lies. The incision most suitable, and which is usually resorted to, should be made along the inner side of the left sterno-mastoid muscle, with its centre midway between the level of the larynx and sternum; the skin, *platysma*, and fascia, having been divided, the outer margin of the sterno-hyoid and thyroid muscles is separated from the inner margin of the omohyoid; the surgeon feeling for the pulsation of the carotid artery, has the vessels and their sheath drawn to the outer side by means of a blunt hook, while the sterno-hyoid and thyroid muscles, with the thyroid gland, larynx, and trachea, are kept towards the inner side; he now carefully makes his way towards the anterior surface of the cervical vertebræ; and in effecting this, the superior and inferior thyroid arteries and veins, and the recurrent nerve, should be avoided. A full-sized probang, or elastic bougie, or a pair of curved œsophagus-forceps, or a lithotomy-staff, should now be passed down the pharynx, so that the walls of the œsophagus may be made to project through the wound in the neck; a longitudinal incision is then made in its coats, and the finger passed through the opening into the canal, while the guiding instrument is withdrawn, and the foreign body sought for. When detected, forceps are introduced, by which it is seized and extracted. After the operation, the patient must be fed for some days by means of the stomach-tube, passed from either the mouth or wound, as may be thought best. By some it has been recommended that the œsophageal opening should be united by sutures, but this is quite unnecessary; and no sutures or plasters should be employed in the outer wound.

Œsophagotomy, as described, has by some been recommended for the removal of foreign bodies lodged within the thoracic portion of the œsophagus. There could be no objection to this, if they were situated so as to be within reach of the finger; but for a mere chance venture at foreign bodies arrested close to the diaphragm, or with the view of employing propulsive efforts more efficiently, the procedure has by no means received the sanction of the profession. By some, also, the operation has been proposed as a means of feeding a patient suffering from obstruction of the pharynx by stricture, either simple or malignant, and which, by producing complete dysphagia, threatens inanition.

CHAPTER XLIV.

AFFECTIONS OF THE EAR.

Congenital Occlusion of the Meatus.

THE meatus may be congenitally imperforate. It may be fully developed in all respects, but covered by integument. In such a case, simple incision of the skin, and careful dressing of the wound, so as to prevent contraction, will suffice to establish the normal state.

Or a thick fleshy covering may conceal the cartilaginous tube, which is only partially developed. And in this case a more careful and regular dissection may obtain a similar result, but perhaps more imperfectly.

Or the external apparatus of hearing may be altogether deficient; the bone itself being imperforate. Such cases are wholly beyond the reach of our art: yet it does not follow that hearing is denied, or even very imperfect. A boy, aged fourteen, came from a distance, desirous of having an aperture made in each auricle; and each of these organs was found very imperfectly developed, of a shrivelled appearance, and wholly imperforate. On making a very careful dissection down to the bone, in search of an external meatus, it became apparent not only that no such tube existed, however imperfect, but that also there was no aperture in the temporal bone. Yet the patient heard ordinary conversation, if distinct and rather loud; he had gone to school at the same age as other boys, and had made equal proficiency in the ordinary branches of education, although no unusual means of teaching had ever been applied to him; and he assisted his father in the occupation of a butcher, with much smartness and intelligence. A series of experiments, conducted by my colleagues, Professors Forbes and Thomson, seemed to shew that he heard mainly by conduction of sound through the bones of the cranium to internal ears very perfectly constructed.*

In some cases the position of the tragus is so valve-like, lying so closely applied over the orifice of the cartilaginous canal, as to interfere very seriously with the hearing power; in such circumstances small tubes like short canulæ should be employed to maintain the patency of the opening.

Supernumerary auricular appendages are sometimes found growing from the sides of the neck; these may consist of mere cutaneous tissue, or contain cartilaginous nodules. They are merely unseemly, and may be removed by two semilunar incisions, which need not be carried deeper than the skin.

* Monthly Journal, Dec. 1846, pp. 420 and 729.

Inflammatory and other Affections of the External Ear.

These may be simple, the result of external injury, as by blows, wounds, lacerations ; requiring merely warm and moist applications for their subjugation. A form of irritation affecting the pinna is due to continuous pressure, as is seen in feeble bed-ridden patients. The inflammatory process is here analogous to the irritation which precedes the formation of bed-sores, and requires a like relief from pressure to permit recovery.

The inflammatory process may be of an erythematous, erysipelatous, eczematous, herpetic, impetiginous, bullous, or syphilitic character, requiring nothing locally special in its treatment. The results of chronic change or ulcerative contraction, by narrowing the meatus, sometimes require a resort, during treatment, to the use of aural tubes, to maintain the patency of the orifice of the canal. The areolar tissue, perichondrium, and cartilage of the auricle, are sometimes the site of an inflammatory process, attended with a very great degree of pain, thickening of the affected textures, and even the occurrence of suppuration. Leeching, hot fomentation, poultices, and opiates to lull the pain, should be employed in the acute form, followed by incision when matter is distinctly present. In the chronic variety, painting with the tincture of iodine, or the application of mercurial ointment, will generally be found sufficient, without blistering, to restore the tissues to their normal condition. Where the perichondrial change seems of a gouty nature, colchicum and iodide of potassium may be advantageously administered internally. Calcareous degeneration of the cartilage of the helix, or anti-helix, sometimes occurs.

Tumours of the Auricle.—These are of four kinds—1, simple hypertrophy ; 2, cystic tumour and hematocele ; 3, encysted tumours ; 4, fibrous tumours ; 5, carcinomatous degeneration and ulceration.

1. *Hypertrophy of the whole Auricle* is an occasional, though rare occurrence. Partial hypertrophy—affecting the lobule only—is more frequently met with ; and chiefly in women who wear ear-rings. If excessive, and irksome to the patient from its unseemliness, the redundancy may be removed by the knife. This deformity, however, may be artificially and intentionally produced ; as by those native Indians who wear a dagger suspended from the lobe of the ear.

2. *Cystic Tumour and Hematocele.*—The latter affection is a remarkable condition, consisting of a sanguinolent serous fluid, contained in a cyst, situated between the perichondrium and the cartilage of the auricle ; met with usually in the imbecile or insane, and liable to be supposed, without reason, due to injuries and blows—occurring accidentally, or inflicted upon them by their companions or keepers. The *Simple Serous Cyst*, containing clear, glairy, gummy fluid, is also met with, closely simulating, yet apparently unconnected with, the hematocele just described. Puncture and the application of a blister is all that is required. 3. *Encysted* tumours sometimes occur singly, but much more commonly in clusters ; they are firmly adherent to surrounding parts, sometimes perforating the cartilage and adhering to the cutaneous textures on the other side. Their removal requires a careful dissection ; and though it

be unseemly to perforate the ear in their excision, this is, practically, rather advantageous—admitting of a free escape of blood, and thus securing speedy union, towards one aspect, at all events, of the surface.

4. *Fibrous tumours* are rare, but occur occasionally, and require excision.

5. The *Cancerous affection* of the ear requires either complete or partial removal of the auricle. This is effected, when it is desired to remove the whole organ, by two elliptical incisions, one in front, and the other behind the meatus. The ear and neighbouring soft parts are then dissected away, cutting through the meatus, and carefully avoiding wound of the temporal artery. To remedy the deformity caused by the removal of the ear, either otoplasty may be resorted to, or an artificial organ, fashioned out of light wood, metal, or gutta percha, may be employed as a substitute.

Otoplastics.

Deficiencies of the auricle—by wound, ulceration, or sloughing—may be repaired by autoplasty. Restoration of the entire organ is scarcely to be attempted; but a portion may be readily replaced—when laxity of the surrounding integument is favourable—by an operation conducted on the same principle as rhinoplasty.

Foreign Bodies in the Meatus.

Children are apt to insert foreign matter into the meatus auditorius, as well as into the nostrils. Dislodgment and extrusion are effected by the same means; by a stream of water injected; or by the use of a flat and bent probe, or curette. Ordinary forceps are useless for the removal of foreign bodies; but forceps suited for the purpose, and worked through the speculum, will be found in some cases very suitable instruments. Some surgeons employ them bent at an angle, others straight; in any instance the limbs of the forceps should be slender, and fully two and a half inches in length. In removing foreign bodies from the ear, a careful examination of the meatus with the speculum should be made. If this is not done, a careless manipulator, passing a curette or probe down to the membrana tympani, may easily mistake the almost metallic sound emitted for a foreign body; and should he attempt forcibly to operate upon this supposed substance, rupture of the membrane, fracture of the malleus, and laceration of the cavity of the tympanum may result. Abortive attempts to dislodge foreign bodies from the meatus have occasioned deeper entrance, disruption of the internal ear, intense otitis, and death. The best speculum is the tubular instrument, swelling out trumpet-wise. The surgeon should possess three or four different sizes. The oval form, although it admits of being introduced more deeply into the canal, is not so serviceable an instrument for every purpose, being apt to interfere with the free play of forceps passed along its channel.

Insects and larvæ sometimes lodge in the ear; causing severe inflammatory mischief there, with much local suffering, and grave constitutional disturbance. Warm oil dropped into the meatus till it is filled, or white precipitate, suspended in milk, and injected, will be found sufficient to

kill the animals ; and they may be subsequently removed by forceps, curette, or a stream of water.

Accumulation of Inspissated Cerumen within the Meatus.

Deafness is very frequently due to this cause ; or, perhaps, obstruction to the vibrations of sound is rendered still more effectual, by commixture of wool, cotton, or other foreign body, with the cerumen ; the patient having been in the habit of stopping his ears, and forgetting from time to time to remove what he had previously introduced. The condition can hardly be called one of disease ; and in many persons it seems, from its recurrence, to be almost a normal state of matters. The accumulation produces, however, in time very material changes in the ear ; dilating the meatus, and causing absorption of its bony walls, but never—a curious fact—modifying the nutrition of the membrana tympani. The deafness produced is very complete, and is the best marked symptom of the morbid state ; often it comes on suddenly, especially after diving in deep water ; it may be increased or diminished on turning the head to one side or the other, and is often accompanied with loud detonation, as if a gun had gone off close to the head. The presence of obstruction will be at once declared by use of the speculum ; and often that is not necessary ; tension and straightening of the tube, by pulling the lobe, before a clear light, being sufficient. Remedy consists in removing the offending mass ; and this is best effected by washing out the meatus with hot water. Cold should on no account be employed, as even tepid water sometimes produces unpleasant giddiness, and an approach to syncope. An india-rubber bag and nozzle will frequently prove sufficient for the purpose ; but when the cerumen is hard, and forms a dense plug, either the common brass syringe, or a Higginson's barrel syringe, with a small nozzle adapted, will be found necessary to effect its dislodgment. The brass syringe is what is commonly employed. In selecting such an instrument, one with a smooth action, capable of containing from four to six ounces and upwards, and of considerable power, should be preferred. The injection should be persevered in, either at one or at repeated sittings, until the membrana tympani is distinctly seen, on the use of the speculum. When the cerumen is unusually hard and tenacious, it may be loosened, previously to syringing, by the careful use of a curette, or by moistening it with bland oil for a day or two.

Deficiency of ceruminous secretion is an occasional symptom of inflammatory affections of the tympanum, and deeper-seated parts of the organ of hearing, but is never in itself a cause of deafness. The meatus is found dry and empty, and the membrana tympani is seen clear and glistening. Stimulants are of use in restoring the secretion—as the essential oils, more or less diluted ; and their action may be further assisted by stimulant friction around the auricle. Exhaustion of the cavity is said also to have a beneficial effect ; by means of a syringe, fitted with a soft nozzle which completely occludes the meatus. Until the normal secretion returns, glycerine applied by means of a hair pencil will be found a valuable substitute.*

* Wakley, *Lancet*, No. 1346, p. 631.

Inflammatory Affections of the Meatus.

The external auditory canal may participate in any of the different inflammatory affections, to which we have seen the auricle is subject, and may either suffer with it or separately. So long as the inflammatory process is strictly external to the membrana tympani, the affection, although troublesome and painful, if acute, readily yields to appropriate treatment; but in many cases it is accompanied by, and is symptomatic of, deeper-seated mischief, implicating the periosteum, the fibrous layers of the membrana tympani, or even the cavity of the tympanum and the mastoid cells. The most common form of acute inflammatory affection of the external meatus, is that depending upon suppuration taking place within one or more of the ceruminous follicles, which are situated in a ring within the cartilaginous portion of the tube; and on looking into the meatus, the site of the abscess can generally be recognised by observing the pea-like swelling of the lining membrane, the greater degree of congestive redness, and the comparative pain on pressure with a probe, at the affected point. The speculum is not required in these cases. The pain and tension are always considerable, and may, in children, create even febrile reaction of the system. The symptoms usually abate in about eight days, or so soon as the matter makes its way into the meatus. But in some cases it tends to burrow externally to the cartilaginous canal, and sometimes points anteriorly to the tragus. These cases are apt to be confounded with acute periostitis of the osseous canal; a much more serious, painful, and tedious affection.

In the early stage of abscess of the ceruminous glands, fomentation, poulticing, or the introduction of a bit of cotton wool soaked in a watery solution of opium, will afford great relief; and so soon as bulging renders the nature of the affection obvious, an incision into the miniature abscess, with an iris knife, will evacuate a bead of pus and afford relief. When the abscess points in front of the tragus, it should be opened there.

The inflammatory process affecting the cutaneous lining of the meatus, usually produces one of two different results. In one the skin becomes brawny, thickened, glossy, and dry, with a sense of painful itching and aching; the swelling is sometimes such that the canal is nearly occluded, while the sensitiveness of the auricle and meatus is greatly increased. This, when acutely induced, will readily yield to leeching within the hollow of the auricle, or anteriorly to the tragus, with the use of fomentation, or the application of wadding soaked in warm oil, to the surface of the auricle. When the inflammatory symptoms are chronic, painting the ear with a solution of nitrate of silver (ten grains to the ounce), or the use of the weak citrine ointment pencilled over the surface when it has been rendered fluescent by heat, will be found to answer better than any other method of medication—such as putting cotton in the ears, or the use of oil and laudanum, or oil of thyme mixed with almond oil, which constitute the popular remedies for this affection.

In the other form a serous secretion is exhaled; and, mixed with this, forming a discharge from the canal, is more or less of desquamated cuticle, in scales, patches, or masses. This discharge is sometimes of a

pappy or pultaceous consistence, at other times serous ; the masses of desquamated cuticle then usually collecting within, and sometimes coming away *en masse*, so as to form a perfect model of the whole external meatus, including the surface of the membrana tympani. Along with this there is usually no ceruminous discharge ; but, instead, a purulent, foetid, and irritating secretion, comes from the glandular structure of the meatus. As this affection becomes more chronic, especially in children, fissuring of the outer part of the canal, attended with bleeding and more copious suppuration, occurs ; and on examining the deeper part of the meatus, the whole surface, including that of the membrana tympani, will be found transformed into a mucous-like vascular surface of a light pink colour. In some instances, weak granulations form, and project so as to hide the deeper part of the canal. In this case, cleanliness constitutes the first and most important element in the treatment. If there is no perforation of the membrana tympani, astringent lotions may be injected after the ear has been washed out. Of these, weak solutions of the salts of silver, zinc, and copper, and of tannic acid, constitute the favourite forms ; while the chloruret of soda, or the permanganate of potash, may be employed when the foetor is very great. When fissuring of the external part of the meatus is present, glycerine should be painted over the tender parts after using the astringent lotion ; and the occasional application of nitrate of silver, through the speculum, to the flabby granulations, by means of a probe or hair-pencil, moistened and dipped in the powdered salt, will be found advantageous in some cases. In children who suffer from this affection, constitutional treatment, and tonic regimen, will usually be required. *Condylomata* sometimes form at the orifice of the meatus, and require the same attention to cleanliness as just described ; sulphate of copper, in substance, or calomel powder, forming the preferable local application. *The periosteum and bone* of the meatus may also be the starting-point of an inflammatory process of acutely painful character. The access may be sudden, or gradual and insidious. In the former case, it is accompanied with violent pain, fever, and even delirium ; the external ear, and soft parts of the meatus, sympathizing in the process. It may terminate in resolution, but much more frequently in suppuration, the pus finding its escape close to the membrana tympani. When this occurs, a probe, curved at the point, and introduced through a speculum, will, on entering the sinus, come in contact with bone either dead or undergoing ulceration. In some cases, and generally, the portion of bone is small ; sometimes, however, it may include a portion of the osseous canal, and even a part of the mastoid cells. In such cases, at the commencement, the treatment must consist in free leeching, with fomentation and opiates to relieve pain. The leeches should be applied within the margin of the meatus, rather than either before or behind the ear. When, however, pain on pressure, and diffuse swelling, exist over the base of the mastoid process, an incision down to the bone will more thoroughly abstract blood and relieve tension. When matter forms, an incision must be made to evacuate it. When, however, it points near the internal part of the meatus, the swelling of the soft parts prevents examination of the canal, and the abscess usually bursts spontaneously ; at once affording great relief to the suffering with which

the patient has previously been racked, and which large opiates have only partially assuaged. During the advance of suppuration, poultices and fomentation should be diligently persevered in. When portions of dead and loose bone are detected, they should be removed, if this is found practicable. When an ulcerated condition of the bone apparently exists, the greatest care and attention must be paid to the maintenance of cleanliness; while repeated blisters behind the ear, or to the nape of the neck, will sometimes check the inflammatory accessions which threaten to recur from time to time.

Chronic Hypertrophy of the Osseous Wall of the Meatus.

This affection may result from an abnormal development, or it may be due to a chronic inflammatory process. The degree of contraction of the meatus thus produced may be so considerable as to interfere very seriously with the hearing power. If all traces of the inflammatory process have subsided, treatment is not likely to avail much, except in rare cases, where it occurs in adults as a result of syphilis. In such circumstances, mercurials and iodine internally, with painting of the canal with the tincture of iodine, may be tried cautiously.

Polypus and other Affections of the Ear.

Two forms of polypi may form on any part of the lining membrane of the meatus externus—usually from that deeper part close to the membrana tympani, but never growing from that membrane;—one soft and pulpy, and of a florid vascular aspect—the “vascular polypus”—analogous to the common mucous polypus of the nose; the other more firm and fleshy, resembling rather the solid polypi of the uterus, the “fibrogelatinous polypus;” both simple in structure and tendency. Deafness is occasioned, along with uncomfortable sensations in the part; and more or less discharge escapes, of a puriform and offensive character. Treatment is by evulsion; forceps being employed for this purpose. These forceps may work in different ways. The simplest are straight, with thin blades, and rounded, or ring-like, and well-roughened extremities, with a binding catch sliding upon the slender blades. Mr. Toynbee recommends the lever ring canula forceps; an ingenious adaptation, for the ear, of the smaller instrument of like kind employed in operations on the eye. Others recommend instruments working in a canula, like the old litholabe, on a miniature scale. Mr. Wilde of Dublin uses a “snare” of silver wire, conducted by a jointed stem, and drawn tight around the polypus by moving a sliding cross bar to which the ends of the wire noose are attached. By the use of the tubular ear-speculum, cautiously introduced, the site of growth is ascertained; then seizure is made of the root of the growth by forceps or snare; and by slight torsion, combined with evulsion, extirpation is effected. Or the attachment may be divided by means of small blunt-pointed scissors, with angled shanks. Should bleeding occur, obscuring our view of the root of the growth, and preventing further efforts to effect its removal, this may be easily arrested at once by injecting the tincture of matico mixed with water into the canal. When

bleeding has ceased and pain subsided—after the use of forceps or scissors—it is well to touch the root with nitrate of silver, by means of a probe either coated with the fused salt, or after being moistened dipped in the powder—so as to diminish the chance of reproduction. And if the morbid structure should not have been entirely removed, such cauterization may require repetition from time to time. During the healing process, relaxation of the membrane, with copious discharge, is apt to prove troublesome; demanding the daily and repeated use of gently stimulating and astringent injections.

Fungoid granulations, of a polypous character, as we have seen, not unfrequently spring from the membrane of the meatus, in cases of long-continued otorrhœa. They grow from the lower part of the tube, or from the membrana tympani itself; and when of large size may simulate polypus. They are got rid of by nitrate of silver, used escharotically, and by the subsequent employment of astringent injections.

Exostosis of the Osseous Meatus.—This is a rare affection, but few surgeons of extensive experience have not met with cases. The exostosis is of miniature size and pedunculated. It projects as a smooth, ivory, or waxen, pea-like mass, towards the canal, occluding it more or less completely. The growth can easily be broken off with the point of a director, or curette, and may be extracted by the same instrument, or by means of polypus forceps.

Encysted Tumours of the Meatus.—These present the usual characters, and by their growth dilate the canal, producing absorption sometimes of its osseous walls, and even coming, by extension, to interfere with the base of the brain, or to project into the mastoid cells. When they occur, free incision and extraction of the sac should be practised.

Medullary growths from the temporal bone sometimes manifest themselves through the meatus, before they make their way to the pharyngeal, orbital, maxillary, or mastoid regions; they are preceded and attended by deafness, and severe pain of a neuralgic character; and are usually accompanied by more or less discharge, and sometimes by hemorrhage. They admit of no interference further than palliation of the pain by opiates.

Inflammatory Affections of the Membrana Tympani.

The *dermal lamina* of this membrane may be affected along with, or separately from, the rest of the skin of the external meatus. The forms which the inflammatory process assumes may be desquamative, suppurative, or ulcerative, and the progress of the disease may be either acute or chronic. When the membrane is implicated in the inflammatory affections of the meatus, there is usually an increase of pain, and of interference with hearing, with some *tinnitus aurium* on the affected side while the presence of thickened epithelial accumulation, vascular change spongy granulation, or of ulceration, can be determined by the speculum. The treatment should be the same as already specified—suited to the inflammatory affections of the meatus. In the chronic forms, it is of importance that the speculum should be employed in making all special applications to the membrane.

The *fibrous layers* of the membrana tympani are very prone to in

flammatory change ; and like all other fibrous membranes, this is specially apt to occur in gouty, rheumatic, and syphilitic subjects. The inflammatory process may, however, affect the fibrous tissues of the membrane secondarily, having commenced either in the dermal layer, or in the mucous surface lining the tympanic aspect of the membrane. The symptoms may be either *acute* or *chronic*. When *acute*, the access is sudden—frequently after exposure to cold. The pain is very severe, deep seated, seeming to shoot through the whole side of the head and neck, increased on motion of the lower jaw, and usually completely preventing sleep. There is always considerable diminution of hearing power, with tinnitus aurium. The pain is also increased by blowing the nose, sneezing, or, in fact, by anything which inflates the cavity of the tympanum. In gouty and rheumatic subjects it is remittent, severely acute at night, becoming less intense in the morning. In syphilitic patients it usually accompanies eruptive affections of the cutaneous surface, and must not be mistaken for the morbid states of the tympanic cavity which form a part of the syphilitic diseases of mucous membranes. Unless complicated by the presence of the exanthemata, there is rarely any inflammatory fever present. On examining the meatus by means of the speculum, its vessels will be seen more or less congested ; even the clear translucent spot in its antero-inferior part partaking in the change. Sometimes the morbid alteration is so complete that the whole membrane becomes of a uniform red arterial tint, or by interlaminar extravasation of blood of a dark venous hue. Sometimes the normal concavity is indistinguishable, and it may even be impossible to recognise the site of the handle of the malleus. The treatment of such a case should consist in free leeching of the hollow of the auricle around the meatus, cotton being placed in the opening so as to prevent the animals from wandering into the canal. After this, hot opiate fomentations, or dry heat applied by means of warm flannel, or a caoutchouc hot-water bottle, or a bag filled with hot salt, sand, or camomile flower powder, may be used. Opiates should be given to lull pain, and at bedtime to secure sleep ; and in some cases colchicum internally will be found of service ; while the use of blisters over the mastoid region, as the acute symptoms subside, will be found signally beneficial. When the inflammatory process threatens to become persistent, constitutional treatment suitable to the chronic form should furthermore be employed.

Chronic inflammatory change in the fibrous tissue of the membrana tympani is always accompanied, when permitted to advance unchecked, by serious structural alteration—such as thickening, hardening, and even calcareous degeneration of the membrane ; nay, in some cases, by perforation from ulceration. This chronic inflammatory process may supervene upon a preliminary acute attack, or may come on insidiously, and almost painlessly. In all such cases hardness of hearing and tinnitus form the prominent symptoms of which the patient complains.

When the speculum is employed, the membrane will be recognised according to the form and progress of the affection, congested, thickened, pearly white, dotted, and either more rigidly tense or more relaxed than in its normal state. If, on attempting to inflate the tympanic cavity, by closing the nose and mouth, and making a forcible expiratory effort, the translucent or mobile portion of the membrane does not move outwards—

then, if the Eustachian tube is not obstructed, the rigid condition is present; on the contrary, should it bulge around the handle of the malleus, then diagnosis of the flaccid condition of the membrane is established. Where, however, there is much thickening, these conditions cannot be recognised. In some cases of relaxed membrane, the inflation of the tympanum relieves the deafness, which again recurs so soon as the escape of the air, or its absorption, admits of the collapse of the membrane being reproduced.

In cases presenting these symptoms, and when every trace of congestion of the membrane is gone, when the affection has been going on for a considerable period, and when the deafness is well marked—unless other symptoms are present pointing to deeper-seated change—there is hardly any use of subjecting the patient to the annoyance of treatment. But when the symptoms are recent and crescent, especially when following upon an acute attack—mercurials, iodide of potassium, and colchicum, with blistering behind the ear, will be found to be attended with very satisfactory effects. In some cases, painting the thickened membrane with a solution of nitrate of silver (ten grains to the ounce), or with the tincture of iodine—or applying the red precipitate or citrine ointment, suitably diluted with glycerine—will be found to improve its transparency and mobility.

When well-marked relaxation of the membrane is present, the application of collodion to its surface has sometimes, by the puckering produced, appeared temporarily to afford support to the malleus, and thus to improve the hearing; this, however, should not be resorted to until all symptoms of an inflammatory kind have been subdued. In many of these cases where chronic changes affect the membrane, the hardness of hearing is much greater than the apparent disease could account for. Changes in the cavity of the tympanum, and of the membrane occupying the fenestra rotunda and fenestra ovalis—or ankylosis of the ossicles, more particularly of the stapes—must then be held in all probability to be present.

Ulceration of the membrana tympani.—This may only lay bare the fibrous laminae, but more commonly it implicates them in the destructive process, either leaving the mucous membrane of the tympanic cavity entire at the site of the ulceration, or perforating it also. The part affected is usually the anterior inferior part, or clear spot. If seen while the ulceration is in progress, a discharge from the meatus, accompanied with more or less decided symptoms of the inflammatory process, mark the progress of this affection. Cleanliness, the occasional use of a solution of nitrate of silver or of its powder applied to the ulcerated surface, and the use of iron, quinine, or mercurials, internally, according to circumstances, with the employment of counter-irritation behind the ear, constitute the essentials of treatment.

Perforation of the membrana tympani may arise from ulceration of the membrane from without, or from pointing of an abscess within; following injuries directly inflicted, or constituting a portion of a more serious lesion of the base of the skull.

When the opening is a slit or rent produced by injury without loss of texture, it usually heals spontaneously, and the part is restored to, or

nearly to, its normal condition. In cases of limited ulceration, cicatrization usually takes place spontaneously with occlusion of the opening ; but when the extent of texture destroyed is considerable, the margins of the ulcer cicatrize, leaving a more or less regularly-rounded aperture. When the antero-inferior portion of the membrane is alone affected, the handle of the malleus is unimplicated ; but when the membrane has been more extensively destroyed, the manubrium stands out by itself with a fibrous shred on either side, extending from its apex to its base, marking the level which the membrane once occupied.

When due to injury recently inflicted, the rent, occupied by a clot of blood, may be easily recognised, after cleansing the canal and introducing the speculum. When ulceration is the cause, it commences from without in most cases ; the membrane is then usually collapsed and drawn in towards the promontory of the tympanum, and the edges of the opening have more or less of an irregular outline.

When, again, the perforation has been produced by a bulging of the membrane with matter contained in the tympanum, there is none of that drawing inwards, and the membrane usually retains nearly its normal position.

The fact that perforation has occurred may usually be suspected from the character of the discharge ; consisting, not of flakes of altered cuticle—as we saw constituted the greater part of the more solid particles in a case of purely external inflammatory affection of the ear—but of a foetid, ropy, or muco-purulent fluid, quite characteristic when floated in water. The existence of perforation is further known to the patient, by the fact that he can blow air through it with a hissing sound during forced inflation of the tympanum ; and on examining the ear with the speculum, the opening may be so large as to be at once apparent, when cerumen, or accreted cuticle, has been washed away from the meatus ; or the aperture may be so small as not to be discernible till the patient inflates the tympanum, when bubbles of air and mucus escape from the orifice. Sometimes one of these bubbles, caught in the opening, receives a pulsatile impression from the impulse communicated to it by the vessels of the part. In some cases the entire destruction of the membrane, with the exception of a narrow ring, leads to the absence of it being overlooked ; the ruddy internal wall of the tympanum being mistaken for a congested, velvety, or granulating condition of the membrana tympani itself. When no other disease of the middle ear co-exists, the mere existence of perforation of the membrana tympani is insufficient to produce deafness. When, however, the aperture is large, the risk of cold attacking the now exposed surface of the mucous membrane of the tympanum, should be borne in mind as a reason for arresting the progress of ulceration when it is advancing ; trusting that cicatrization may occur. Failing that, measures should be employed to supply the want of natural protection which the membrana tympani naturally afforded to the parts within.

The treatment therefore consists essentially of two parts—of the ulcer itself—and of the deficiency produced by the destruction of the membrane.

The treatment of the ulcer, we have already seen, consists in the

use of local applications—such as nitrate of silver, and moist cotton wadding—the former applied every three or four days, the latter daily ; while, internally, tonics should at the same time be employed.

The treatment of the deficiency resulting from the perforation, should consist in employing measures to check the chronic irritation of the mucous membrane of the tympanic cavity, by means of nitrate of silver solution applied with a small hair pencil, and blisters externally ; with local use either of cotton wadding according to Mr. Yearsley's method, or of the artificial membrana tympani according to Mr. Toynbee's plan.

Mr. Yearsley recommends the daily introducing of a small and thin portion of cotton wadding soaked with water, either by means of a pair of forceps, or by his probe contrived for this very purpose. The cotton is introduced through the speculum, and carried down till its surface touches the membrane, and then it is smoothly applied over the aperture by means of the probe. When it is desirable to permit the patient himself to introduce and remove this wadding, a thread should be tied to the fragment, by which extraction is effected. By the surgeon, forceps may be advantageously substituted for other methods, both in the introduction and removal.

Mr. Toynbee's artificial membrana tympani consists of a rounded portion of very thin caoutchouc, secured in the middle with a piece of silver wire. When it is to be employed, its margin should be smoothly cut to correspond to the size of the canal, as gauged by the eye. The membrane, moistened in hot water, is now passed through the speculum, till it comes in contact with the surface of the remains of the natural membrana tympani. The surgeon judges he has reached this point, by the depth to which the wire has been passed, by the sensations of the patient, and by the instantaneous improvement in hearing thus produced. The little instrument should be withdrawn daily, and the ear cleansed ; then it is to be reintroduced, either by the surgeon, or by the patient when he has acquired a sufficient acquaintance with its manipulation. The effect in restoring hearing power is sometimes quite magical ; but in other cases, where disease exists in the cavity of the tympanum and in still deeper parts, although the artificial membrane may be useful as a protective agency, and may thus by degrees improve the hearing power, there is little or no appreciable effect at first. This beneficial result, apparently due to its protective agency, gives a clue to explanation of the fact, that in some cases the hearing is so much improved after the continued use of the artificial membrane, that the patient comes to hear as well without as with it.

Affections of the Middle Ear.

This portion of the organ of hearing, consisting of the cavity of the tympanum and its contents, with its two offshoots, the mastoid cells and the Eustachian tube, is liable to various modifications of structure which impair the hearing power in various degrees.

These diseases for the most part originate in the inflammatory process, which may either affect the whole of the middle ear and its annexes, or one or other of these alone.

Acute Inflammatory Affection of the Tympanum.

This may be produced by injury inflicted from without, as by laceration of the membrana tympani, in ill-directed efforts to remove foreign bodies or polypi from the meatus, or by attempts to introduce the Eustachian catheter—or by the injection of stimulating lotions, either through the catheter or into the meatus, when perforation of the membrana tympani exists. More commonly, however, the inflammatory affection commences in the pharynx or posterior nares, constituting one form or other of acute cynanche, and extends along the Eustachian tube to the cavity of the tympanum. The most acute and destructive cases are those which come on after or in the progress of scarlatina.

The symptoms at their commencement are those so constantly experienced by every one who has suffered from a smart attack of cynanche tonsillaris, or violent coryza, extending to the posterior nares, viz., a pain commencing in the throat, and shooting upwards and outwards towards one or other of the ears, attended with some dulness of hearing—improved temporarily, with a crackling sound, on blowing the nose. As the inflammatory process advances, the pain becomes greatly increased, acutely lancinating in its character, diffused over the whole side of the head and neck, and accompanied by a sense of throbbing amounting almost to the feeling as though the head would burst; the attempt to swallow aggravates the pain, so that the patient cannot venture upon the effort; and the forcible manœuvre to inflate the tympanum is both ineffective and very painful. There is usually pain on pressure over the mastoid process, and above the tragus. On examining the meatus with the speculum, the canal is sometimes found tumid from sympathetic implication. When, however, the symptoms have not run on so rapidly, and the canal is pervious, the membrana tympani is seen to be perfectly normal, except that its vessels are congested, and the ruddy glare of its turgid thickened mucous covering is visible through its outer layers; but as the products of the inflammatory process accumulate within the tympanic cavity, even before bulging of the membrana occurs, this becomes manifestly thickened, and presents much the appearance of a cornea softened by advancing keratitis. In such circumstances the symptoms usually indicate grave constitutional disturbance; violent feverish excitement and restlessness occur, opiates scarcely lull the pain, and, in children, delirium, convulsions, and even death from coma, may ensue. More commonly, however, the inflammatory process stops short of suppuration, and the membrane is more or less completely restored to its normal state. Or, suppuration occurring, the abscess of the tympanic cavity is evacuated by the Eustachian tube, or by perforation of the membrana tympani, and escape of matter from the meatus. Disorganization of the mucous membrane, necrosis of the ossicles, and even of a portion of the osseous walls of the tympanic cavity and of the mastoid cells, with extensive external abscess, have also been known to result. The suspicion in these last cases, however, always is that the affection has been of the nature of necrosis from the beginning, and not that the mucous membrane of the tympanum has not been its starting-point. When an ear has once suffered from such changes in its parts, permanent deafness

of greater or less intensity must be anticipated, and a chronic foetid discharge (internal otorrhoea) will continue, so long as any source of irritation still remains in action—whether this reside in the perverted nutrition of the mucous membrane, or depend on the presence of dead or ulcerating bone within the cavity.

The treatment of such cases should consist in active leeching, and the administration of antimony with calomel and opium. Whenever the symptoms present an increasing severity, and resist what is sufficient in slighter cases, viz., the use of warm gargling, and hot opiate poulticing of the jaw and throat—these warm and moist applications should be prolonged, so long as the acute stage of the inflammatory process continues. Should suppuration occur, and the bulging of the membrane be recognised, a free incision should be made anterior to the handle of the malleus, with an iris knife introduced through the speculum. This will afford instant relief. When tenderness—and still more, swelling and redness—exist over the mastoid process and its base, a free incision should be made down to the bone through the superimposed tissues.

As soon as the inflammatory symptoms begin to subside, whether suppuration has taken place or not, the progress of the case is usually hastened by the repetition of blisters behind the ear, or to the nape of the neck.

While matter continues to flow from the aperture in the membrana tympani, the greatest attention should be paid to cleanliness, by daily washing out the meatus with the syringe. Should the free escape of the purulent secretion appear to be prevented by the smallness of the aperture, this should be enlarged; usually, however, such interference is not required, ulceration of the membrane having established a very free and sufficient aperture of escape. When such free aperture exists, the injection of warm water should be employed carefully, and the use of astringent solutions should be abstained from.

Constitutional tonic treatment, and measures to establish the patency of the Eustachian tube, should it be found to be obstructed, must also be attended to as circumstances seem to direct. The risk of a relapse should be borne in mind, and every precaution taken to guard against it.

Chronic Inflammatory Affections of the Tympanum.

These are recognised by their results.

Thus, in children, mucous or muco-purulent fluid is frequently found filling the tympanic cavity without any perforation of the membrana tympani. The affection also occurs in adults, but less frequently. In the child, the bulging of the membrane, thickening of its texture, and more or less of a pulpy macerated aspect, attend upon such accumulation, without, however, the pre-existence of any acute inflammatory symptoms. By some, however, convulsive affections occurring in infancy and childhood have been referred to the existence of such accumulation in the cavity of the tympanum.

In the adult, opacity of the membrana tympani, with sometimes a increased concavity, will be found to exist. The patient complains of

some interference with hearing, usually worse in damp, and improving in dry weather. Sometimes tinnitus is present, sometimes not. On desiring him to swallow, or to attempt forcible inflation of the cavity of the tympanum, on air enters the cavity; while by using the Eustachian catheter and the otoscope, a gurgling or bubbling sound is produced by the passage of air into the fluid, and its displacement from the cavity.

Such cases are frequently found to be associated with enlarged tonsils, or with a congested and thickened condition of the mucous membrane of the fauces. The disease is thus apparently an extension of a chronic affection of the pharyngeal mucous membrane and its glandular structures.

The treatment should, therefore, consist not merely in employing gentle counter-irritation, such as friction with a liniment composed of tincture of soap and tincture of cantharides, behind the ear, but in the application to the throat of such agents, more particularly nitrate of silver or tincture of iodine, as are calculated to restore the mucous membrane of the fauces to a healthy state. Should enlarged tonsils exist, they should always be removed as an essential preliminary. Constitutionally, tonics, and alteratives, such as iron, cod-liver oil, iodine, and Donovan's solution, should be administered according to the state of the patient's system.

Thickening of the mucous membrane of the tympanum may exist without perforation of the membrana tympani; but dissection proves this to be rare. As an accompaniment of such perforation, or as a result of the same inflammatory process which produced it, a thickening of the mucous membrane, resembling the flabby granulations of a weak ulcer, may be seen by means of the speculum; and when the perforation is large, and the granulations prominent, this may by a careless or inexperienced observer be mistaken for a polypus of the external auditory canal. In such circumstances, should we be sure that no disease exists in the bone forming the walls of the tympanum, nitrate of silver in substance, in powder, or in solution, may be applied through the aperture in the membrane. By some a solution of caustic potash has been recommended in the treatment of this affection, on the ground, probably, that it has been found of use in (the not in the least analogous condition) granular conjunctiva. When disease of the bone exists, the less meddling, beyond keeping the meatus clean and the perforation of the membrane unobstructed, the safer and better for the patient. There seems no sufficient means of diagnosis to justify a resort to any treatment, in cases presumed to be of the nature of thickening of the mucous membrane of the tympanic cavity, when no aperture exists in the membrana tympani. No doubt a congested, opaque, thickened, pinky membrana tympani, an obstructed Eustachian tube, and a nondescript sound when the otoscope and Eustachian catheter are employed, as of something entering the canal, but with neither the full free thud of a healthy ear, nor the mucous rôle of a tympanic cavity containing fluid—have been mentioned as symptomatic of this state of matters. These symptoms appear to us hardly definite enough; implying as they do absolute certainty on the part of the observer, before he comes to any conclusion whatever, that his Eustachian catheter is really in the canal—of which

fact he can have no positive assurance, unless, indeed, he is able to decide the matter absolutely by means of rhinoscopy.

Abscess of the Mastoid Cells.

The inflammatory process may originate in the cancellated texture of that part of the temporal bone which constitutes the base of the mastoid process. It may be the result of external injury ; more frequently it occurs without any appreciable exciting cause, in systems of the strumous character ; and is most especially liable to invade those, whose original cachexy of system has been further aggravated by the occurrence of syphilis. It is most frequently met with in the young. But very often this disease is but the extension of an originally external affection ; namely, long-continued inflammatory change of the external meatus. If suppuration be attained to, in connection with periostitis or otitis of the canal—as is extremely probable — caries may hardly fail to be established ; and will usually be complicated with the separation of portions of the osseous texture in the form of sequestra. From the near connection of the posterior surface of the cells with the dura mater of the cerebellar cavity, it can easily be understood how readily, in advanced cases, the latter texture may be involved. The lateral sinus, too, is in close contact ; and, while perforation of this vessel may give rise to hemorrhage, the implication of its walls in the advancing inflammatory process may determine the occurrence of a thrombosis which, breaking down, sets up pyæmic symptoms and metastatic abscess.

The symptoms are those already described as characteristic of the inflammatory process affecting the cavity of the tympanum, with, however, more tenderness, puffiness, and even sometimes redness, over the base of the mastoid process.

Supposing the affection to be acute, treatment in the first instance will be directed to averting suppuration, if possible ; an incision over the mastoid process should be made down to the bone, from base to apex. When no such antiphlogistic incision has been practised, and matter has formed, an early and sufficient opening should at once be made so as to limit the mischief. In any case there is great danger by extension. The internal ear having been involved, hopeless deafness will ensue ; paralysis of that side of the face is not unlikely, from implication of the portio dura ; nay, it is possible that the contents of the cranium may be attacked, as already stated, directly and imminently perilling existence. Trephining of the mastoid cells over the base of the mastoid process has therefore been recommended to give exit to the matter pent up within ; and the proceeding does not seem at all unreasonable, theoretically considered. The cases requiring it must, however, be of very rare occurrence, as the matter formed there would probably seek its way, ere any injury could be produced from pressure, into the tympanic cavity, and then either escape by the Eustachian tube, or present itself invitingly through the bulging membrana tympani to the knife of the surgeon. Independently of internal complications, life may be hazarded, when the suppuration is copious, by the hectic of a continued and wasting discharge.

In chronic cases, but little good need be expected from local treatment alone ; constitutional means must be at the same time, and sedulously, employed. When employing counter-irritation, the blister should not be placed over the part affected—otherwise the disease might be increased ; but at a distance, as on the nucha, or between the shoulders.

Fibrous Bands extending between the Walls of the Tympanum and its Ossicles, Rigidity of the Mucous Membrane of the Tympanum, Anchylosis of the Stapes to the Fenestra Ovalis, Earthy, Osseous, and Scrofulous Formation, and Masses of Cholesterine, are pathological conditions which have been met with in dissections of the middle ear, with different frequencies ; the first mentioned being most common, the latter less so. The diagnosis of their existence is to be effected only upon a principle of exclusion, with probably the exercise of some amount of imaginative ingenuity on the part of the surgeon. Practically the treatment of such conditions must be a matter of hap-hazard—unless, indeed, other indications of morbid change—in the membrana tympani, for example—and the recent occurrence of the symptoms, should induce the practitioner to resort to mild counter-irritation ; or unless the presence of some gouty, rheumatic, or scrofulous affection elsewhere, requiring treatment, be attended by a manifest amelioration in the condition of the patient as to both gout and deafness. Otherwise, a hearing tube is the only resource likely to prove of real service in overcoming the latter, which, with tinnitus, constitutes the only prominent symptom.

Obstruction of the Eustachian Tube.

Clearness of the tube is ascertained by directing the patient to shut his mouth and nostrils, and then to expire forcibly, as if blowing his nose. He will be sensible of a click in the ear, produced by the shock of air acting on the membrana tympani—supposing this to be entire ; and the sound will be very plainly heard by the surgeon, through a stethoscope placed on the mastoid process. If the tube be open, but clogged with mucus, the noise is of a gurgling or crackling kind.

When obstruction exists, it may be due to change in the osseous portion of the canal ; but far more commonly it depends on thickening of the mucous membrane, from simple congestion or oedema, or follicular change in the orifice of the tube. Sometimes it is produced by contraction of the textures composing its pharyngeal extremity, which have been implicated in an ulcerated condition due to syphilis or some other cause. A cancerous change in the textures of the part, or the advance of a polypus, whether simple, fibrous, or cancerous, from the posterior nares, may produce the same symptoms by occlusion of the extremity of the tube.

To the pressure of enlarged tonsils a like effect has been assigned, and no doubt the two conditions of enlarged tonsil and obstructed Eustachian canal frequently co-exist. The true explanation, however, of the concurrence of these two conditions is that they are both due to a like condition of disease, affecting the mucous membrane and its follicles, and possibly kept up and perpetuated by the presence and proximity of the enlargement of the tonsils.

Where such enlargements of the tonsils exist, their removal should constitute the first step in our treatment; as thereby applications to the relaxed or thickened condition of the mucous membrane of the pharynx, and posterior nares, will be more satisfactorily effected than they could be while the enlarged tonsils occupied the fauces.

The relaxed membrane should be treated by local medication with a solution of nitrate of silver, applied by means of a bit of sponge fixed on a curved stem of whalebone, or by a large hair pencil, or injected through the nostril by means of a short catheter attached to a vulcanite syringe. Suitable constitutional treatment should be at the same time adopted. The occasional forced inflation of the cavity of the tympanum will afford, in most of these cases, a temporary, complete, or partial relief, sufficiently indicating the limited nature of the maintaining cause.

When no such mere faucial cause of obstruction is found to account for the symptoms, when no polypus, tumour, or cicatrix is to be felt with the finger carried up behind the soft palate, and rhinoscopy reveals nothing to the inquirer, the *Eustachian catheter* may be employed with the view of determining the presence and nature of the cause of obstruction.

The Eustachian Catheter has been used either as a means of diagnosis or of treatment. This instrument is of various sizes, varying from a No. 3 of the ordinary catheter scale, up to a No. 8 or 9. It should be six inches in length, with a short curvature at its distal extremity; and the orifice should be terminal, not lateral. The patient, in whom it is to be passed, should occupy the sitting posture. The instrument having been oiled, the surgeon passes the beak of the catheter along the floor of the nostril, till it reaches the level of the soft palate; he then rotates the point gently outwards and upwards, when it will be felt to sink into the trumpet-shaped opening, and to be immovable when a backward or forward motion is attempted. Some surgeons in passing it carry the instrument on till it touches the back wall of the pharynx, then rotate its point outwards and upwards, and as it is withdrawn it passes into the canal. To ensure the position of the catheter in the Eustachian tube, the negative symptoms of absence of pain or uneasiness, or the non-interference with speech and deglutition, may suffice; but the finger passed upwards behind the soft palate, or the use of the rhinoscope, will serve still further to make the certainty absolute. To introduce air through the catheter into the tympanum, an air-press was formerly employed; but at the present day, the mouth and lungs of the surgeon are used more safely for this purpose, either immediately applied to the end of the catheter, or mediately by means of an elastic tube fitted to the catheter, and with a mouthpiece. The otoscope—a similar elastic tube, fitted with two terminal nozzles for introduction into the corresponding ears of patient and surgeon—having been applied, the surgeon blows into the Eustachian tube through the catheter. Should all be normal, the air enters the tympanum, and distends the membrane with a “*thud*.” When obstruction is complete no air enters, and no sound is produced. When the canal is partially obstructed, and the middle ear is occupied with fluid, the gurgling or bubbling is quite pathognomonic; and other râles, already mentioned in the preceding pages, occur to indicate the

presence of thickening or binding down of the textures contained in the tympanic cavity.

The Eustachian catheter has also been employed for the less legitimate object of attempting to inject medicated vapour or fluid into the tympanic cavity.

Puncturing the Tympanic Cavity.

This is effected through the membrana tympani in cases of abscess of the middle ear. It may also be resorted to in cases of deafness, when no other cause than obstruction of the Eustachian tube can be discovered to account for the symptoms. By some it has also been resorted to where the membrane of the tympanum has become very much thickened and rigid, and where by the admission of the vibrations directly to the cavity of the middle ear, one cause of interruption to sound, it may be hoped, will be removed.

To effect this little operation, several ingenious instruments have been contrived, the aim in the construction of which has been to remove a circular portion of the membrane, so as, as much as possible, to interfere with contraction and healing of the wound. Of these the most ingenious is that of Fabricci. "It consists of a canula, into which slides a spiral wire, somewhat resembling that of a cork-screw. It is to be used in the following manner:—Pass the canula with the spiral wire down upon the inferior part of the membrana tympani (so as not to interfere with the manubrium of the malleus), retain it there with the left hand, being careful not to press too firmly on the membrane; then, with the right hand, take hold of the small handle which revolves the spiral wire, and turn it from right to left, being what is usually called turning the *wrong way*. The instant at which the membrane is perforated is sensibly felt by the operator. The wire is now no longer to be turned; but by its handle the instrument is to be retained in its situation; then gently revolve the canula, which has a cutting edge, from left to right, when a circular portion of the membrana tympani, corresponding to the diameter of the canula, will be cut out, and at the same time drawn into the canula and held fast by the spiral wire." Or, instead of this instrument, a trocar, volute and sharp in the sides, may be employed; turning it quickly in the membrane, so as to excise the punctured portion. These instruments are, however, unnecessary in practice. An angular incision, forming a triangular flap, should be cut with an iris knife inserted through the speculum, and union prevented by the occasional introduction of a probe coated with nitrate of silver.

Otorrhœa.

We have already seen how by this term is understood a puriform or purulent discharge from the external meatus; usually preceded by the ordinary signs of an attack of an acute or subacute inflammatory nature. Children are most liable to this affection; and especially those of strumous habit. Often it is one of the sequelæ of scarlatina. It must never be forgotten that the term Otorrhœa, in truth, comprehends many morbid states; inflammatory affection of the external ear, of the cavity of the

tympanum, or of the mastoid cells. It is therefore essential to examine the meatus by means of the speculum, discharge having been previously removed by gentle injection. For if the *membrana tympani* be found entire, and tolerably sound, the affection is so declared to be comparatively simple—unless, indeed, necrosis or caries of the osseous meatus be its cause; whereas, if that membrane be found imperfect, denoting an internal origin of the suppuration, prognosis is rendered more guarded and unfavourable.

It is equally important, however, to observe, that the inflammatory process, begun even in the external meatus, may at any time extend to the other parts, and thence to the contents of the cranium; as, for instance, from the meatus and mastoid cells to the cerebellum or lateral sinus; in the former situation resulting in the formation of a chronic abscess in the medullary substance, in the latter by the supervention of thrombosis, and softening of the clot, inducing pyæmic symptoms. When the tympanic cavity is affected, the extended inflammatory process usually impilcates, either singly or conjointly, the *dura mater* and middle lobe of the cerebrum. When the labyrinth is diseased—and this is usually consequent upon discharge of the ossicles after suppuration of the middle ears—the suppuration is often found to follow the course of the auditory nerve along its canal towards the medulla oblongata. Mr. Toynbee's remarks are worthy of remembrance on this point. "No person," says he, "suffering from chronic catarrhal inflammation of the dermoid layer of the meatus, the *membrana tympani*, or of the mucous membrane of the tympanum, can be assured that disease is not being prolonged to the temporal bone, the brain, and its membranes; and that any ordinary exciting cause, as an attack of fever or influenza, a blow on the head, etc., may not induce the appearance of acute symptoms, which, as a general rule, are speedily fatal."

Treatment is mainly palliative and expectant, as regards the part; restorative as regards the system. The constitutional cachexy is to be combated by the usual means. The ear is kept clean by frequent and careful use of tepid water, without and within the meatus. The state of the mouth is looked to; and, if need be, any offending teeth or stumps removed. Re-accessions of inflammatory disease are averted or subdued, by occasional leeching and fomentation, as circumstances may require. The chronic affection, which is maintaining the structural and functional disorder of the mucous membrane, is sought to be overcome by careful counter-irritation—such as blistering behind the ear and nape of the neck; this, however, being proceeded with cautiously, lest enlargement of the cervical glands, which frequently is an accompaniment of otorrhœa, should be either induced or aggravated. When nearly all the symptoms of inflammatory disease in the part have subsided, and when the general system has decidedly improved, weak astringents, injections, or direct applications, may be employed, to favour recovery of the membrane, and consequent cessation of the discharge. This part of the treatment, however, must always be conducted with the greatest possible care; lest, by the irritation thereby produced, there should occur both sudden arrest of the discharge, and aggravation of the inflammatory process, in a deeper site. Such risk is in all cases to be apprehended, when

we observe a sudden arrest of discharge to occur from any cause ; but especially in those cases in which implication of the middle ear is indicated, by imperfection of the membrana tympani, and perhaps previous discharge of the ossicula auditus.

Otorrhœa in the adult may be connected with the lodgment of foreign matter in the meatus, long overlooked. A grass-seed, or such like substance, may be extruded after many years ; otorrhœa—occasional or constant—having been maintained during the whole period of its residence.

Otorrhœa is occasionally connected with a general carious condition of the pars petrosa of the temporal bone ; which has softened, and become hollowed out into a cavity, containing only granulation texture. The symptoms, sooner or later, are cerebral and obscure. The issue is hopeless. And it is very plain that the fatal event would certainly be much accelerated by our attempts to arrest the aural discharge. Cases, however, have occurred, in which inflammatory affection of the petrous portion of the temporal bone has terminated in death of the part affected, attended with suppuration and copious and prolonged otorrhœa, but in which the patient has made a good recovery without any head symptoms having appeared, and in which that part of the bone, including the whole or a portion of the labyrinth, has been discharged from the external meatus.

Cancerous disease of the temporal bone often commences with violent pain resembling that of acute inflammatory affection of the middle ear, or of otalgia, and after a time is attended by a sanious discharge from the meatus. On examining with the speculum, a polypoid-like mass is seen, which bleeds on the slightest touch. These tumours may prove fatal by extension of the growth towards the brain ; or, enlarging towards either the fauces or the surface, they either exhaust the patient by pain, or prove fatal by the bleeding which supervenes after the open condition is attained. In such cases, treatment either of the discharge or of the polypoid-like development is worse than useless. Attention to cleanliness will, however, add much to the patient's comfort.

Affections of the Internal Ear and Organ of Hearing.

We have already alluded to the different inflammatory affections which may implicate these parts. When, from suppurative destruction of the middle ear, the ossicula are discharged through an opening in the membrana tympani, and the stapes is included in the sequestrum, the aperture of communication with the labyrinth must of course be involved, with more or less complete annihilation of the function of the parts within. Or, again, in those rare cases where recovery has followed necrosis of the portion of bone including either the whole or a part of the labyrinth, deafness cannot fail to exist ; or, where a like destruction of the all-essential part of the organ of hearing has occurred from caries, it is easy to understand that complete deafness must follow.

Various morbid conditions of the parts composing the internal ear have been demonstrated ; as, for instance, extravasation of blood occupying the labyrinth, the presence of large quantities of otoconia or of pigment,

anhylosis of the stapes to the fenestra ovalis, ossification of the fenestra rotunda, the existence of exostoses or tumours pressing upon the fenestræ, or upon the auditory nerve, and lastly, atrophy of the nerve, or of its distribution. Our knowledge of these conditions is chiefly due to the painstaking devotion of Mr. Toynbee to the subject; but our acquaintance with them has not added much to our diagnosis of their existence, and still less to the range of treatment. They are of importance, however, as demonstrating the absurdity of a long-continued treatment of cases where symptoms are wanting to indicate the existence of the different forms of disease already described; which, till recently, were confounded with each other, and with the very vague disease, *nervous deafness*, which, indeed, was intended to include all cases of an obscure and intractable kind. Practically, perhaps, such is still the case. Nervous deafness is presumed to be due to some diseased condition of the auditory nerve or of its organ of distribution; but the cases in which the nervous apparatus is really at fault should still further be limited to those examples, where not only no appreciable organic change in the organ of hearing can be observed during life, but also where the deafness is so absolute that sound is not even recognised by communication through the bones of the head. The treatment of such cases mainly consists in attention to the state of the general health, an entire absence of anything like severe measures, with the employment of gentle counter-irritation, and the use of remedies suited to control the syphilitic, gouty, or strumous diathesis, if present.

Organic Change in the Brain is not an unfrequent cause of deafness; and seldom admits of successful treatment. Hopes of amendment will mainly rest on counter-irritation, and on mercurialism moderately employed.

Functional Disorder of the Nerve is fortunately a more frequent, as well as more hopeful cause; variously induced—as by blows, falls, loud noises, disorder of the general health, etc. Besides obviating the inducing cause, employing counter-irritation, and perhaps venturing on mercurialism, benefit may be obtained from the endermic use of strychnine—as in the analogous case of functional amaurosis. Or some advise a few drops of an alcoholic solution of strychnine to be dropped into the ear, or to be injected through the Eustachian catheter, from time to time. This has also been of late years recommended in the treatment of distressing tinnitus aurium by Kramer, who attributes this symptom not to any morbid condition of the auditory nerve, but to irritation acting upon the *chorda tympani*.

Determination of Blood to the Head, in consequence of suppression of normal or habitual discharge, or however induced, is not unlikely to produce a certain degree of deafness, along with noises and other unpleasant sensations in the head. Treatment is by leeching or cupping, purging, and other means ordinarily found available to overcome local plethora.

Otalgia.

This constitutes true earache; a neuralgic affection, unconnected, directly, with the inflammatory process. Very frequently it is con-

nected with irritation in the mouth. The pain is very distressing, and has all the characters of neuralgia. It is amenable to the same treatment; search for a dental cause or connection never being neglected. Among the anodynes suitable for application to the part, aconite and belladonna deserve a prominent place.

Hemorrhage from the Ear.

Blood, escaping by the ear, may proceed from various sources, and requires different treatment accordingly. 1. One of the most prominent symptoms of fracture at the base of the cranium is bleeding from the ear; amenable to no direct treatment; and usually an unfavourable omen. This is usually due to the line of fracture establishing a communication between the sinuses of the dura mater and the middle ear, the blood escaping externally by a rent in the membrana tympani. In several cases of this kind, where undoubtedly no such communication existed between the sinuses and the tympanic cavity, the vessels of the membrana tympani, and the torn arteries and veins of the tympanic cavity, probably furnished the blood. 2. Mere laceration of the lining membrane of the meatus may cause a copious discharge of blood, independent of any injury done to the cranium, or elsewhere. It, too, requires no direct treatment—not being likely to prove excessive. And it is not a sign of an untoward character. It may be the result of a blow, fall, or direct injury done to the part. 3. Passive hemorrhage may take place from this, as from mucous surfaces; amenable to the ordinary treatment, local and constitutional, suitable in such cases. 4. The internal carotid may have been opened into by ulceration. The hemorrhage is constant, copious, and of the arterial character. Pressure may be tried, with styptics, but may fail. The only sure remedy is ligature of the common carotid artery. 5. The lateral sinus, opened by ulceration, may be the source of bleeding—dark and venous. In this case, while ligature of the carotid would prove wholly nugatory, moderate pressure is found to be quite effectual.

CHAPTER XLV.

AFFECTIONS OF THE NECK.

Glandular Enlargement and Abscess.

AFFECTIONS of the lymphatics in the neck, as elsewhere, may either be symptomatic of some simple source of irritation affecting the parts of the head and neck from which the vessels come which communicate with the affected glands, or may constitute a special disease of itself, usually connected with some general or systematic disorder. Thus, in scrofulous adolescents, the glands of the neck are very liable to enlargement, by a chronic inflammatory process; and frequently, notwithstanding every effort to the contrary, suppuration is reached—causing more or less deformity by unseemly cicatrization. The ordinary enlargement of the cervical glands, so frequently met with in scrofulous patients, must, however, be carefully distinguished from the syphilitic glandular affection, characterized by implication of the whole chain of lymphatics on both sides of the neck, along the anterior margin of the trapezius. This condition is of importance to the practitioner, not on its own account, but because it constitutes so excellent a symptom of constitutional syphilis—nay, may be said to be almost absolutely pathognomonic of its existence in any case where we find it present. The glands affected are painless, about the size of small hazel-nuts, indurated, and never suppurate. They become affected in this manner before any eruptions make their appearance on the surface, and continue sometimes long after any other constitutional symptom remains. Another form of glandular enlargement of almost stony or cartilaginous hardness sometimes occurs. This is usually confined to one side of the neck, and involves the lymphatic chain; though one gland may be, and often is, larger than the other. The hardness resembles very closely that of scirrhus, but the disease has no connection with the cancerous cachexia. It is rather associated with anæmia—perhaps accompanied with enlargement of the thyroid; and in some instances it is attended by anæmic palpitation and exophthalmos. The pressure of the enlarged glands upon the nervous branches of the cervical plexus produces pain, often extending to the shoulder, and down the arm upon the affected side. In the nascent stage, we endeavour to arrest progress by removal of the cause of the enlargement; as by the removal of decayed teeth; by curing eruptive affections of the scalp; and by controlling inflammatory affections of the ear. When the enlargement is due to a constitutional cause, and the patient manifestly scrofulous, we seek to do good by constitutional treatment suited to the strumous diathesis, by fomentation, and subsequently, when all acuteness is past, by the application of iodine, or other discutients, or by more decided counter-irrita-

tion. When matter has formed, an early evacuation is practised by incision; the wound being made as minute as possible, and in the direction of the folds of the neck, so that its cicatrix may escape observation. A common lancet is the preferable instrument. Sometimes the use of potass is demanded; the integuments having been much undermined, and the prominent fungating gland requiring disintegration. A blister applied over the part, and for some distance round, will usually, however, serve the same purpose, and appear less formidable to the patient. In the after-treatment of suppurations in the neck, cure is often delayed by over-dressing the part—covering it with too many envelopes—especially when the patient is not confined to the house. The object of such dressing is to conceal the state of matters from public observation, and to guard against exposure to cold; but the result often is, to maintain a degree of congestion in the part, favourable to continued suppuration, and unsuited to contraction and consolidation of the abscess.

The syphilitic glandular enlargement requires the ordinary treatment of the syphilitic infection. In the case of the nondescript affection of the glands, which may with justice be called anæmic, local treatment seems of no avail; although pain may be palliated with opiate applications, while digitalis, iron, and henbane, or belladonna, sometimes seem to afford relief when administered internally; but the disease usually remains stationary and unyielding.

When an acute abscess has formed at all deeply in the neck, whether connected or not with affections of the lymphatics, evacuation by incision cannot be too soon had recourse to, otherwise serious mischief can scarcely fail to ensue. Dyspnoea may be produced, either by direct pressure on the trachea, or by implication of the recurrent nerve on either side. Fascia is made to slough; areolar tissue is broken down; the trachea and œsophagus are each liable to be opened into by ulceration; the mediastinum, or pleural cavity, may be involved; the jugular vein may communicate with the abscess; or, still more disastrously, by communication with the carotid artery, the cyst of the abscess may be converted into the sac of a false aneurism. And then, when the wound for evacuation—too long delayed—is at length made, the most serious consequences are inevitable.* When the abscess points towards the middle line, an opening directly into its sac should unhesitatingly be made. In the case of matter forming acutely in the anterior triangle, close to the larynx, hyoid bone, and distribution of the external carotid artery, or about the angle of the jaw, or in connection with the upper part of the pharynx, or in the subclavian triangle, the opening of the purulent collection requires more careful consideration of the relation of the abscess-sac to the vessels and nerves of the region. This condition is made still more embarrassing by the inflammatory swelling and thickening both around and superficially, producing a communicated and diffused pulsation, and giving a false idea of depth. Where the difficulty becomes such as to render a simple puncture of the supposed abscess, and extension of the opening, a foolhardy procedure, a careful dissection should be made; cutting down upon the important parts in relation with the sac, and avoiding them in laying it open. It should

* Monthly Journal, June 1855, p. 552.

also be remembered that a chronic glandular abscess in this region, lying beneath the deep fascia in contact with the carotid artery, at or near its bifurcation, may be mistaken for an aneurism, and that such faulty diagnosis has occurred in the hands of men of the greatest talent and practical sagacity. The careful consideration of the antecedent history of the case is alone likely to save the surgeon from such a grave error, as a resort to ligature of the carotid artery would be in such circumstances.

Tumours of the Neck.

Solid tumours, when of such a nature as not to be amenable to discussion, require early removal, otherwise each day will but add to the difficulty and danger of the operation; and when at last matters are found to brook no further delay, it is not impossible but the hazard may be found so much increased as to render any attempt at extirpation quite unwarrantable.

In considering the propriety of undertaking operative measures on account of any tumour of the neck, its relations to surrounding parts should be carefully considered along with its essential nature. The great practical rule always to be remembered is, that tumours underlying the sterno-mastoid, and, still more, the sterno-hyoid and thyroid muscles, do not admit of operative interference. Such tumours are generally malignant; and although they may externally seem unattached, yet when the fascia is divided, and the superficial portion of the mass laid bare, it may be found to include the carotid artery, internal jugular, and vagus nerve, in its textures—nay, it may be already attached to the vertebræ or pharynx. Such obstacles to the removal of a tumour, however, have not daunted some operators. No doubt the carotid artery and jugular vein may, if divided, be secured by ligature; but as hitherto the removal of all such deep-seated growths, even at an early period, has been followed by fatal consequences, there can be no great inducement to follow such an example. Cases, however, of fibrous tumours, situated beneath the deep fascia of the neck, and deeply furrowed by the tense sterno-mastoid, have occurred, where the operation of excision has been successfully undertaken, the tumour proving to be quite unconnected with any important parts.

In connection with this subject, it is well to remember, that in cases of tumour underlying the deep and strong cervical fascia in the interval between the muscles, it may seem to be less deeply seated than it is really; and that, consequently, much caution is always expedient in effecting its removal, it being probable that the common sheath of the large vessels will have to be exposed—perhaps to some extent. The dissection should therefore be made through an ample external incision, and the textures divided towards or upon the tumours, while the deeper attachments should not be touched until the whole surface towards the margin has been fully exposed on every side.

Bronchocèle, or Goitre.

The term denotes a tumour due to enlargement of the thyroid gland.

The swelling varies in size from a mere fulness of the neck, constituted by a slight exaggeration of the normally large thyroid gland of females, to a bulky, uniformly rounded, pendulous or lobulated tumour occupying the front of the neck from chin to sternum. This morbid growth may be of various kinds. 1. *Mere hypertrophy* is most common; the enlargement being essentially chronic and very gradual; and ultimately making a transition into the state of simple tumour. The whole gland may be equally involved; or the isthmus alone may enlarge, while the lobes remain of a normal character; more frequently one or other lobe is the seat of the partial affection; and sometimes both lobes are involved, while the central portion remains free. And indeed, the same remarks, as to the partial or general character of the swelling, apply to the other varieties of the affection. On manipulating the simple vascular-sarcomatous enlargement of the thyroid which constitutes the common goitre, it is felt to be of a soft elastic consistency, sometimes distinctly pulsating, and capable to some extent of being diminished on pressure. Its vascular element and the feeding thyroidal arteries are much enlarged, and are principally related to the tumour laterally and posteriorly. Any operative procedure, therefore, which divides even the branches of these vessels, is attended with very active and profuse bleeding. This form of tumour on section presents a smooth glossy surface of a yellowish colour, and minutely-granular structure. 2. The swelling may be of a *cystic* nature; the stroma being analagous to the structure of simple tumour; the cysts either numerous and small, or few and capacious, delicate, and filled with a glairy fluid—or large, and containing blood, sometimes pure and arterial, at other times dark, thick, and grumous. 3. The simple stroma may contain a greater or less amount of *calcareous* matter; giving much density to the tumour, which is seldom then of large size. 5. The tumour may be *malignant*. Carcinoma is rare. Cephaloma, which is not so, follows its ordinary course, and presents its usual characters.

Bronchocele is, in certain localities, an endemic disorder. In the Tyrol, and in the valley of the Rhone, it is especially so; and there almost invariably associated with the sad mental condition to which the term Cretinism has been applied. In this country, the disease is comparatively rare, and happily such an unfortunate combination but seldom exists. In Derbyshire, Dumfriesshire, and some other counties, both in Scotland and England, however, it merits the appellation of endemic. The majority of the patients are female; and the ordinary period of invasion is about the time of puberty. The most prominent symptom is inconvenience, with deformity, occasioned by the bulky swelling. Growth is gradual and painless—unless in the malignant variety. The indications by touch vary according to the nature of the interior. As the tumour enlarges, headache and giddiness often occur, in consequence of venous return thence being interfered with; and respiration also is more or less seriously impeded, by pressure on the windpipe—especially when the central portion of the gland is affected. Partial enlargement—affecting but one lobe—is apt to be mistaken for a separate tumour, or to simulate carotid aneurism, receiving a decided impulse from the adjacent vessel; and careful manipulation is necessary to arrive at a correct diagnosis. In addition to the ordinary diagnostics, it is to be

borne in mind that, on deglutition being performed, a bronchocele will be found to move upwards with the larynx, while an aneurism remains unaffected.

The causes of the disease are scarcely yet evolved from obscurity. Where endemic, it seems certainly connected with habitual use of unwholesome water as an article of food, and habitual exposure to a humid atmosphere; and this circumstance necessarily possesses an important bearing on the question of cure. There are cases, again, exposed to no telluric influence of an appreciable kind, where we have anæmia, palpitation, bronchocele, and exophthalmos combined. The source of this composite disease, quite as much as the mutual relation of the symptoms, has for many years been a subject of inquiry and discussion among physicians. By some the anæmia is considered as the starting-point, by others the bronchocele, while by others a condition of the spinal nervous centres acting upon the sympathetic, and referred to some derangement of the uterine system, has been presumed to be at the foundation of this remarkable affection.

Treatment.—In reference to treatment, the examples of this disease may be conveniently divided into three classes; those which are merely deformities, unseemly, and somewhat troublesome by their bulk; those which bring life into peril, directly or indirectly, by interference with the brain and the air passages; and those which, by reason of their malignant character, as tumours, sooner or later are fatal. These last—fortunately rare—are generally hopeless throughout their entire course. But for the second class, the most determined remedial means may be with all propriety resorted to. For the first, heroics are not warrantable. And, fortunately, the majority of cases, in this country, demand only the milder form of treatment. Iodine has long been regarded as the most powerful remedy; and justly. Internally, it is administered in the form of iodide of potassium—or combined, as with iron. Externally, it is applied in the form of solution, painted frequently on the swelling—or ointment or liniment is rubbed in—moderate leeching having been premised, in those cases in which continuance of nutritive excitement may seem to render such a measure expedient; our object being to arrest growth, as well as to discuss bulk already attained. At the same time, habitual exposure to a dry and otherwise salubrious atmosphere, with habitual use of sound water—chalybeate if possible—are curative indications by no means to be neglected. And such treatment will be carefully maintained, so as to prevent a tumour, originally of the first class, from becoming of the second, and seriously perilling life by interfering with both breathing and circulation.

The anæmic form of bronchocele, where we find the combination of anæmia, palpitation, bronchocele, and exophthalmos, may be found to improve under the administration of belladonna, or henbane, with iron and valerian. In such cases, iodine, so far from proving of service, will be found positively injurious.

Central tumours, pressing on the windpipe, may be removed by operation, when of no great size; partly by excision, partly by deligation. By the scalpel the integuments and muscles are freely divided, and turned aside; the tumour is laterally separated from its connections, care being

taken to secure each arterial orifice by ligature, so soon as divided, and each venous orifice—as far as possible—by pressure of the fingers of an assistant; and having proceeded as far with the knife, in the work of detachment, as prudence will allow, the remainder of the connections are to be included tightly in ligature. A strong needle is passed beneath the base of the tumour, the double ligature is divided, and each portion is tied separately, so as to strangulate the mass. Tumours of the isthmus have been thus removed successfully; and it is probable that the same principle of operation may sometimes be extended to other swellings not limited to that part of the gland.

Large, solid bronchoceles, involving the whole gland, and of greatest bulk laterally, are not amenable to such radical cure. Their size, site, and attachments, preclude the use of ligature; and attempted removal by the knife could scarcely fail to prove fatal by hemorrhage. The ligature of the thyroid arteries practised by Sir W. Blizard, and previously proposed by others, has sometimes been apparently successful in checking the development of the tumour. But in other cases, death has speedily resulted from the profuse suppuration and sloughing which has resulted from the operation. Of late an ingenious mode of procedure has been devised by M. Porta; founded on observing that the large arteries which supply the thyroid gland do not enter the interior of it, but break up into numerous small branches at the circumference, and that consequently hemorrhage need be dreaded only when the exterior part of the tumour is interfered with. Besides, the majority of simple bronchoceles he found to consist of numerous cellular or cystic developments, which push aside the proper texture of the gland, reducing that to the condition of a simple envelope, on dividing which the new products are exposed, or may be extracted without difficulty, injuring only small vessels, and leaving behind a fleshy sac which collapses, without further trace of the tumour. Accordingly, the operation is performed thus:—the integuments of the neck, and subjacent parts, are divided by incision; the tumour is cut into, avoiding the trunks of the thyroid arteries; if any of these spring, they are tied or twisted; the exposed cysts are removed by forceps, or the handle of the knife; more solid structure, if it exist, is broken down and extruded by the same means; and bleeding having been arrested, the wound is closed.*

In hopeless cases life may be protracted, and great relief afforded, by subcutaneous section of one or both sterno-mastoid muscles, so as to diminish tension, favour outward growth, and relieve the trachea and jugular from compression. In some cases, also, protraction and palliation may be obtained by tracheotomy; when the circumstances of the case are such as to render the performance of that operation practicable.

For the purely cystic bronchocele, simpler means may supersede the more formidable operation of M. Porta. Iodine may be injected as in hydrocele, and the result will usually prove equally satisfactory. By some the seton has been employed in the treatment of the cystic as well as the solid form of the disease. The cyst having been punctured, and its contents evacuated, a few threads of silk may be passed through the substance of the swelling, and retained. It is probable

* Brit. and For. Med. Chir. Rev., Jan. 1851, p. 106.

that the inflammatory result will lead to obliteration of the cystic formation ; but much care is necessary in watching the process, lest it prove excessive, and threaten asphyxia through sudden and great enlargement of the swelling. For the solid tumours, the seton is not well adapted ; it not only fails to discuss, but is also exceedingly prone to accelerate growth.

After tapping and injecting cystic bronchoceles which contain a thick, grumous, bloody fluid, arterial hemorrhage may occur into the sac. In such circumstances the swelling rapidly enlarges, pulsates, and may threaten asphyxia by pressure on the trachea. Should this unfortunately occur, a free incision should be made into the sac, and the hemorrhage, which is certain to be very copious, may be arrested with compresses of lint soaked in the perchloride of iron, and temporarily retained, either by strips of adhesive plaster, or (better) by two or three stitches introduced between the edges of the wound, so as to keep them firmly in their place.

Tumours over the Thyroid Gland.

Not unfrequently cystic formations are found, not in the substance of the thyroid gland, but between this and the integument. If of small size and circumscribed, they may be dissected out. Those which are large may be treated by injection.

Enlargement of the Thyro-hyoid Bursa.

Like other bursæ, that which is situated between the hyoid bone and thyroid cartilage is liable to enlargement, chronic or acute ; causing more or less swelling, with pain, and obstruction to the movements of the neck. The acute form is met by repeated leeching and fomentation ; the chronic is appropriately treated by the local application of iodine in solution, or by puncture and the use of blisters.

Hydrocele and Hematocele of the Neck.

Hydrocele and Hematocele of the neck are not uncommon ; occupying the front and back aspects and subclavian space, originating from no very obvious structure or lesion, and the contents of the cyst being more or less clear, straw-coloured, or sanguinolent. The cyst is thin, superficial, and seldom of very large size. Sometimes the production of the swelling is sudden ; and its progress in growth may be rapid ; after a time, however, becoming stationary, and proving inconvenient mainly by its bulk. Tapping, with subsequent injection of iodine, as in other serous accumulations, will usually prove successful. Should this fail, a small seton may be inserted ; or free incision may be practised, filling the cavity with lint so as to induce suppuration of the sac, with subsequent granulation from the bottom of the wound.

Opening of the External Jugular Vein.

Occasionally it is deemed expedient to extract blood by opening the

vein at its lower part, so as to obtain a reflux flow of blood from the larger veins and right side of the heart—for example, in cases of cardiac disease, or of great pulmonary engorgement with consequent obstruction to the circulation on the right side of the heart, as occurs in deep coma, in embolism of the pulmonary arteries, and in extensive capillary bronchitis or pneumonia. In cases, again, where air has been admitted into the circulation, it has been proposed to open the right vein, and by it to convey a glass or gum elastic tube of suitable size through the innominate vein into the vena cava superior, and so onwards into the right auricle, with the view of permitting regurgitant escape, and thus relieving the patient from imminent death. More commonly, however, this situation has been selected as a means of abstracting blood from the distal extremity of the vein—to serve the convenience of the operator, as in children, when the veins in the arms and legs are deeply seated and difficult of detection—or in cases of inflammatory disease of the head and neck, under the impression that such a plan of venesection relieves more directly not only the surface of the head, but also the interior of the cranium. In performing this operation, bulging of the vein is produced in the first instance by pressure of the thumb, applied immediately above the clavicle; and then an incision is made obliquely upwards and outwards over the posterior border and in the same direction as the fibres of the sterno-mastoid muscle; this divides the overlying fibres of the platysma myoides across their axis, and a widely gaping external opening, with freedom of flow, is obtained. Thereafter the thumb's pressure may either be maintained, or the edge of the bleeding cup may be made to take its place, so long as the flow of blood is desired; it is then withdrawn; and this circumstance, of itself, is usually sufficient to arrest the bleeding, except in those cases where regurgitant bleeding is desired. In that case no pressure is needed; the vein bulges spontaneously, and the failing flow of blood shews that the congestion of the right auricle and ventricle is relieved. In checking the hemorrhage it is always well either to place a small compress on the wound, retaining it by means of a long strip of adhesive plaster, or to transfix the edges of the wound with a fine needle, and keep them in contact with a ligature applied in a figure of 8. During the blood's flow, precaution is advisable to avoid entrance of air into the vein. Of course there is no fear of this taking place when the right side of the heart is over distended.

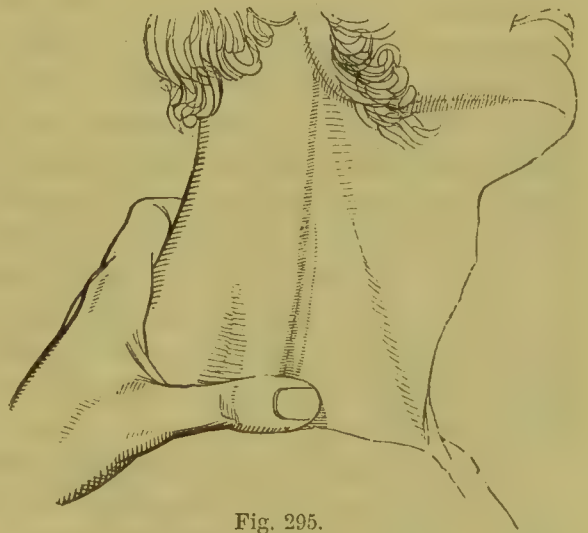


Fig. 295.

Fig. 295. Venesection in the neck. The external jugular shewn distended by pressure of the thumb, previously to insertion of the lancet.

Torticollis. Wry-neck.

By this term is understood a distortion of the neck, dependent on muscular disorder—spasm, paralysis, or change of structure. The muscle usually to blame is the sterno-cleido-mastoid. One, acting with the undue energy of spasm, overpowers its fellow, and displaces the neck accordingly—the back of the head being carried forwards on the affected side ; or one, affected with a loss of contractility, fails to afford the usual counteracting power to its fellow ; or, by the inflammatory process and its results, abbreviation and condensation of one or other muscle may occur, causing distortion of a very unpromising character ; or the malformation is congenital.

Children, shortly after birth, are not unfrequently found to labour under a certain amount of torticollis, from more or less complete paralysis of the muscle upon the side towards which the face is turned ; in these cases the affected muscle seeming either to have been inadequately developed, or somehow to have become partially paralyzed. Friction over the spine, and on the muscle which is weak—with care, on the part of the nurse, to exercise the faulty muscle by position of the head, yet without fatiguing the extensors—usually suffices to effect gradual but satisfactory amendment.

In a similar state of matters, in the adolescent or adult, the endermic use of strychnine, or the injection into the muscular substance of a 1-60th of a grain of the solution of the salt, or the electro-magnetic stimulus, may be had recourse to.

Spasm of the muscle may be either temporary or permanent. The former most frequently occurs in children ; and is to be treated by purgatives and alteratives, followed by anti-spasmodics internally ; locally by fomentation, leeching, belladonna, and counter-irritation. Permanent spastic rigidity of the muscle is more common in the adolescent and adult ; perhaps a remote consequence of the former affection. Mercurial friction and active counter-irritation to the nape of the neck may be tried ; but with no sanguine hope of success. Such cases are, however, well suited for tenotomy ; and that not merely on account of the deformity, but to avoid a more serious evil—curvature of the spine—which often supervenes, and which may, if unchecked, become both considerable and confirmed.

The operation to be really of service must be employed—not in every case, but only in those where no paralysis of the opposite muscles is present, and when no permanent curvature in the cervical and dorsal vertebræ is already superinduced. A division of the *sterno-mastoid* should be performed about an inch above the sternal extremity of the clavicle. Here the tense and prominent sternal portion of the muscle can easily be included between the finger and thumb, and the tenotomy knife having been inserted either between the skin and the surface of the muscle, or beneath the muscular fibres, is carried backwards and forwards with a gentle sawing movement, till the gap between the ends of the muscle proves that all has been divided. In making the incision from without inwards, a careless operator might plunge deeply, and injure the artery and vein. This, however, is scarcely possible with anything approaching to

ordinary care ; as the muscle stands out in relief, and makes the distance between its posterior surface and the vessels even greater than it is normally. To secure safety in this respect, some recommend to puncture with the ordinary tenotomy knife ; and then, withdrawing this, to substitute a similar instrument with a rounded point wherewith to effect the section of the muscle. In cutting from within outwards, the risk of dividing the skin is much greater than that just mentioned, and requires on that account some attention on the part of the surgeon. Usually it is quite sufficient to cut the one origin ; but sometimes division of both heads is essential. By resilience of the severed extremities, restoration of the normal state is at once produced ; and this is maintained by suitable bandaging ; or a frontal fillet, with strap behind on one side, buckling to the corset or waistbelt, if need be, should be employed, until the muscle on the opposite side becomes so commensurately contracted as to be able to maintain the head in its proper position.

A similar operation is the only means whereby we may expect to cure the third form of the affection ; that proceeding from structural change in the muscle by inflammatory results.

Twisting of the neck is caused also by tumours—glandular and others ; as well as by the contraction of extensive burns, and disease of the cervical vertebræ. The principles of treatment in these cases are obvious. Care should, however, be taken, in making a careful diagnosis between them and the forms of wry-neck suited to treatment by myotomy.

Wounds of the Throat.

Wounds of the throat are of two classes ; those inflicted by the hand of the suicide, or of the murderer ; and those made by the surgeon. The former now engage our attention. They are usually made in a transverse direction ; and high in the neck—above or at the thyroid cartilage ; the latter circumstance being probably connected with the popular idea, that, to effect extinction of life, it is sufficient to open the air-passage, and so cause suffocation. The extent and consequent importance of such injuries vary very much ; from mere scratches, penetrating no deeper than the subcutaneous areolar tissue, to the most ghastly severing of all textures—almost to decapitation. Sometimes the incision is made immediately beneath the chin. Not unfrequently it is placed between the hyoid bone and thyroid cartilage ; the mouth being opened into, and the epiglottis cut off or divided, while the air-passage is left intact. Sometimes the weapon is drawn across, a little above the clavicle ; and then, if any considerable depth be attained to, death is certain and immediate. Sometimes the knife, held as a dagger, is plunged into the lower part of the neck ; to the imminent risk of the larger blood-vessels. But the region of the larynx is that which is most frequently involved.

The first danger is by hemorrhage. If the carotid and jugular have been reached, death is very speedy, and can scarcely be prevented. Such extreme wounds, however, are of comparatively rare occurrence ; the vessels being protected, high in their course, by the depth of their situation in reference to the front of the neck—especially during the position in which the head is held during the infliction of the wound—

and by the density of the parts which have to be divided ere the sweep of the sharp edge can reach them. Sometimes even the pharynx or oesophagus may be severed, and the vessels escape, their sheath being laid bare, and even the internal jugular vein cut through, while the artery is merely notched in its outer tunic. When, however, the deed is attempted with a truer skill and deliberation, not by a horizontal gash, but by a puncture in the direction of the vessels, the escape of these is likely to prove rather the exception than the rule. A more limited transverse wound, leaving the carotid and jugular intact, may still cause death by hemorrhage, directly, and within a brief period; by implication of the lingual, facial, or possibly of the thyroid vessels—arteries and veins. The position occupied by these last-mentioned vessels, close to the side of the larynx, generally saves them from injury, and the former are only likely to suffer when the incision is made above the hyoid bone. And again, a comparatively slight bleeding may prove fatal, more remotely; the blood making its entrance into the larynx during respiration, and accumulating within the air-passage, so as to induce asphyxia; such accumulation being permitted by the insensibility of the patient, or by his inability, through faintness, to make the requisite efforts for expectoration.

The second danger is by inflammatory changes at the wounded part; occluding the laryngeal aperture or canal, or otherwise interfering with respiration. And this is all the more likely to occur, if the wound implicating the larynx have been brought together immediately after the infliction of the injury. The mucous membrane, as well as the rest of the wound, becomes the seat of an acute inflammatory process; and the consequent swelling may be such as to cause rapid and great occlusion. At the same time, mucous secretion is both increased in quantity and vitiated in quality—becoming more viscid and tenacious. This, accumulating in the already narrowed canal, renders suffocative hazard all the more imminent. And the risk is further contributed to, by the diminished power of expectoration which a patient so situated necessarily possesses.

A third danger, liable to occur along with, and to aggravate that which has just been considered, is—that, during the movements of the part—voluntary and involuntary—one portion of the wound is not unlikely to overlap the other, and thus, by suddenly producing a mechanical obstruction to the passage of air, at once to bring life into the greatest peril.

A fourth danger is by the occurrence of inflammatory change in the trachea and lungs; the inflammatory process extending downwards from the wound, or the unwonted direct access of cold air proving an exciting cause of original affection. Bronchitis, indeed, more or less severe, is almost an invariable consequence of such injuries.

A fifth danger arises from inanition, in those cases in which the gullet has suffered; and when, consequently, it is not easy to maintain a due supply of nourishment. Hectic, also, may ensue, in the case of an extensive, profusely suppurating, and slowly-healing wound; more especially if much blood have been lost at the time of the infliction of the injury.

And lastly, the mental condition is, in all cases, likely to exert an

untoward influence on the bodily frame. In not a few examples, when dissipation has led to the rash and guilty act, life is perilled at an early period by the occurrence of delirium tremens. Or this, indeed, may have been some time in progress, and may have caused the suicidal attempt. And in those cases which have been preceded by gloomy, brooding despondency, a continuance of low mania, accompanied with typhoid symptoms, will usually paralyze our best remedial efforts, and determine a fatal issue by sinking.

Thus it can be readily understood, how few cases in surgery present more obstacles to satisfactory treatment than do those of cut throat. We overpass one difficulty and danger only to meet another. And too frequently, after the most prominent evils have been skillfully counteracted, the patient slowly yet surely sinks under chronic typhoid symptoms, intimately connected with mental alienation.

Treatment.—When called to a case of cut throat, it is absolutely our first duty to arrest the hemorrhage. And this is done by pressure of the arterial orifices; pressure being applied, it need not be venous points. If the wound is above the hyoid bone and opens into the mouth, so soon as the bleeding has ceased, the edges and surfaces of the wound should be approximated with wire sutures. When, however, the wound is at or below the rima glottidis, then only the angles of the wound, if very extensive, are to be approximated by suture, the centre being left free. Approximation there is only afterwards to be effected, by attention to position of the head—keeping the chin, by bandaging if necessary, depressed towards the sternum; and even this is not done, until all risk of bleeding from the wound has ceased, and all tendency to displacement of the divided surfaces of the trachea or larynx is past. If the chasm be at once drawn tightly together, immediate risk is greatly enhanced, as already stated; and yet this is an error which has very frequently been committed, in the hurry of actual practice. Blood, coming from the cut parts, does not find a ready escape externally, but either trickles into the air-passage and accumulates stealthily there; or is infiltrated around the line of wound, causing compression of the windpipe by the increasing coagulum; in either way threatening suffocation. The viscid mucus, too, is more likely to entangle itself in the still wound, and inflammatory turgescence is more prone to prove untoward. Air, also, is likely to be infiltrated into the areolar tissue, during respiration, causing troublesome and dangerous emphysema. When, on the contrary, the wound is left centrally free, these latter risks are not only less likely to occur; but also, in the event of their occurrence, untoward tendency can be much more readily and effectually counteracted. It need scarcely be added that the dressing of the wound should be most simple; consisting, not of a complication of plaster, compress, and bandaging—but of a mere strip of lint, moistened in water, and loosely and lightly retained upon the part.

The main bleeding having been secured, and the wound partially approximated, the patient is laid on his side so as to favour outward escape of the continued oozing. And the cut part is protected from unfavourable atmospheric impression, by a covering of loose gauze, or of woollen texture, thrown lightly over the neck; attention being at the

same time paid to maintain an equable and genial temperament in the apartment. Duly qualified attendants are at hand not only to guard against repetition of the suicidal attempt, but also prepared to separate and clear the wound, should swelling and entanglement of mucus render such a proceeding necessary to prevent suffocation. And the patient should be instructed to facilitate his expectoration, by completely shutting or very much diminishing the wound, by means of his fingers, at the time of the effort being made. It is hoped that the wound will inflame, granulate, contract, and cicatrize, in the ordinary way; and the local treatment is conducted with that object in view. Constitutionally, we have to guard against favouring inflammatory access in the wound, and in the air-passages, through neglect of antiphlogistic measures; and, on the other hand, we must beware of aggravating the tendency to sinking, which sooner or later becomes apparent in the majority of cases. As a general rule, blood-letting from the system is seldom if ever warrantable.

Should the pharynx or œsophagus have been wounded, the use of a tube becomes necessary to convey nourishment to the stomach. In some cases, also, where the gullet is not injured, but the injury done to the larynx or trachea is extensive, the use of the feeding tube becomes expedient. In the first case, during the ordinary effort of deglutition, unless the tube is used, the ingesta necessarily escape more or less copiously by the wound, and so do harm in many ways; in the second, by employing the tube the necessity for the act of deglutition in administering food is avoided, the parts are kept at rest, and healing of the wound is expedited. The feeding tube cannot be inserted from the wound—although the

facility of such a proceeding may invite the attempt—otherwise closure of the wound must be seriously interfered with. If intended to be introduced and worn permanently, until the pharyngeal or œsophageal aperture shall have closed, it is passed by the mouth, carried into the œsophagus, and then the proximal end is withdrawn by the nostril and retained there. But it is found to be more expedient to introduce the tube only occasionally, by the mouth; twice or thrice daily, as circumstances may seem to require. It is not necessary to pass the instrument completely down to the stomach; it is enough that its extremity is placed fairly beyond the wound. And, of course, the precaution is not neglected of ascertaining that lodgment is rightly accomplished, ere fluid nourishment is begun to be introduced. One very obvious objection to the permanent retention of a tube, whether passed by the mouth or by the nose, is that its extremity, pressing against the posterior part of the windpipe, is apt to occasion ulceration

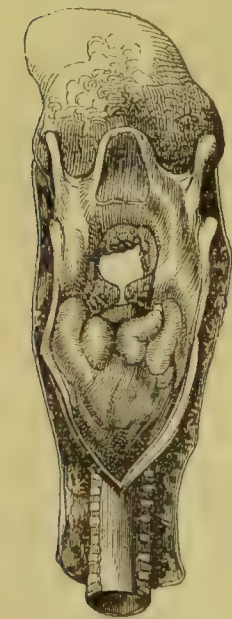


Fig. 296.

there, which may perforate; complicating the case untowardly, by the establishment of tracheal fistula. Should this occur—as has happened—

Fig. 296. "A view from behind of the larynx of a patient who some weeks previously attempted suicide, by wounding the fore part of the neck. By some mismanagement, the edges of the incision were kept asunder; and they cicatrized. The patient was seized with difficult breathing; the inspirations were rare, long, and labo-

the ordinary test of the tube being rightly placed will probably fail; air, in expiration, escaping by the tube in the œsophagus, as well as by the natural outlet.

Throughout the whole cure, the state of respiration must be sedulously watched. And should threatening of suffocation intervene—as is not unlikely, due to some tracheal cause—and prove of such a nature as not to be removed by freely opening up the wound, and throwing the head back over the pillow placed behind the shoulders, tracheotomy is to be had recourse to unhesitatingly. Then the canula being retained in the tracheal wound, the transverse aperture may be brought together, and treated so as to favour rapid union—there being no longer any risk from internal swelling or other change at that site.

I have often thought, that in extensive transverse wounds of the neck, implicating the windpipe, however inflicted, tracheotomy may be regarded as expedient at an earlier period; that is, shortly after arrest of the hemorrhage, and partial approximation of the wound; so soon, in fact, as the patient has rallied sufficiently to bear the immediate effects of the operation. For then we would have it in our power to place and maintain the whole track of the wound in perfect apposition, and perhaps to procure union almost by the first intention. So soon as the chasm had fairly closed, the canula might be withdrawn, and the tracheal opening cautiously and gradually shut. And thus, also, would we be more likely to avoid the occurrence of fistulous tendency in the suicidal wound; which, in the ordinary progress of cure, is not unlikely to prove troublesome. In performing the operation, it will be expedient to raise and steady the windpipe, by means of a hook fixed in the lower margin of the transverse wound.

In those cases in which recovery has been delayed from the tedious healing of the wound, there is a risk of the larynx becoming contracted in its calibre, so as seriously to interfere with normal respiration; and all the more probably if a fistulous opening has become established by imperfect closure of the wound. Such cases are doubtless unpromising; yet are capable of being brought to a prosperous issue. The contracted passage may be dilated by bougies passed from the mouth; and, the normal capacity of the larynx having been restored, the fistulous opening may be made raw, and approximated by suture. A successful case of this nature occurred in the practice of Mr. Liston.* This procedure is, however, difficult, and may prove unsatisfactory. It should, therefore, be the aim of the surgeon to obtain early closure of the wound, and thus prevent the occurrence of laryngeal contraction.

* LISTON'S Elements, p. 435.

rious; and he had threatening of suffocation during his disturbed sleep. These symptoms were disregarded. He started up suddenly in the night, caught hold of the patient in the next bed, and fell down in a state of asphyxia, from which he could not be recovered. The cedematous swelling of the rima glottidis is remarkable; beyond that, is seen the rounded opening betwixt the thyroid cartilage and the epiglottis—which last is in a normal state.”—LISTON, Elements, p. 432.

Bronchotomy.

Under this general term are comprehended the surgical wounds of the throat—Laryngotomy and Tracheotomy ; made in a vertical direction ; artificially opening the windpipe, with some important remedial object in view. But before treating of these operations, it may be well to consider briefly the various circumstances which may demand their performance.

Foreign Bodies in the Windpipe.

Foreign bodies, held in the mouth, are apt to pass into the windpipe, during sudden inspiration—as in speaking, crying, or laughing. During inspiration, the glottis is opened wide, and a foreign substance, even of considerable size, may pass readily inwards. For expiration, however, a comparatively narrow opening of the rima suffices ; an aperture quite insufficient for the outward escape of the intruding substance ; and, indeed, such escape is still further opposed by the effort to produce it, which, impinging the foreign substance on the tracheal aspect of the rima, stimulates that part to spasmodic contraction.

The foreign substance may remain loose within the windpipe ; moving from part to part, according to the circumstances of displacement. Or it may lodge at a particular site :—1. In the larynx ; becoming entangled in the ventricles ; or being of such form and size as to be impacted in the general cavity. 2. It may be similarly fixed across the trachea ; pins, portions of glass, and other sharp substances, for example, have been thus impacted. 3. In either bronchus. And the right being the more directly continuous with the trachea, in that the impaction is most likely to occur. 4. Or the body, of small size, may gravitate still lower, and take up a lodgment in one or other of the bronchiæ. 5. Or giving rise to irritation, it may gradually become enclosed in an abscess-sac, and thus be separated, except by an aperture of communication, from the air passages. 6. Or it may be impacted in the very rima glottidis. Thus :—a man much intoxicated, becomes almost insensible, and is sick. The contents of the stomach are lazily evacuated upwards ; and a portion of the ingesta may enter the rima, and remain there, causing suffocation. A piece of potato-skin has thus proved fatal. Or, again, large substances, held in the mouth, and forced downwards in sudden inspiration, may prove too bulky to pass through the rima, and become impacted there ; inevitably causing suffocation, unless instant relief be obtained, either at the hand of Surgery, or by the patient's own expulsive efforts. And in such a case, unless the tightness of impaction be great, success is more likely to follow the instinctive throes, than in the case of smaller bodies within the larynx ; spasm of the glottis being mechanically prevented, and consequently proving no obstruction.

The symptoms denoting the occurrence of such accidents are, in general, tolerably clear. The history of the case is generally distinct. A patient, with a foreign body in his mouth, during an access of immoderate laughter, or during the act of ordinary deglutition, is all at once seized with a violent paroxysmal cough, recurring at intervals, and not preceded or accompanied by any signs of constitutional inflammatory

disturbance. If impaction have taken place in the rima, the symptoms are those of rapid asphyxia ; the patient suddenly exhibiting the greatest distress, becoming livid and swoln in the countenance, staring with bursting eyeballs, gasping anxiously, struggling for breath, and speedily becoming insensible. When the foreign body has passed within the rima, the symptoms vary according to the site and nature of the lodgment ; but, in all cases, they evince two leading characteristics—denoting obstruction to respiration, and irritation produced in the part with which the substance is in contact. If it be loose in the windpipe, or lodged in the larynx or upper part of the trachea, the following are the ordinary symptoms. A violent fit of suffocative cough immediately succeeds the entrance of the foreign body—seeming to cease, it is probable, only on Nature having been wholly exhausted. And, at short intervals, such paroxysms are renewed ; more particularly if any new movement of the foreign body have occurred. Inspiration is loud, strained, and of a harsh, croupy, or sawing sound. The voice is changed. Pain is complained of in the part. A more or less copious expectoration of mucus takes place, and sometimes of blood. The countenance is suffused, and expressive of great anxiety—an expression almost pathognomonic, especially in the young. And the neck is stretched, with the head elevated and thrown back, in the position of orthopnoea. Often all the auxiliary muscles of respiration are found in full play. It is right to remember, however, that in some cases—more especially when a considerable period has elapsed since the occurrence of the accident—the intervals between the paroxysms may be passed in comparative quiet, with an almost total absence of symptoms at that time. When impaction has taken place in a bronchus, a characteristic sign is indicated by auscultation—suppression of respiratory sound on that side, with puerile respiration in the opposite organ. The respiratory movements of the parietes of the chest, too, are diminished or arrested in the obstructed part. Or a still more plain indication may be afforded, if the substance happen to be of musical capability, however rude, and so situated that the air passing by it in respiration may evoke its powers of sound. Rough substances soon occasion purulent discharge, which possesses great and characteristic foetor. Sometimes the foreign body, when smooth and loose, may be felt distinctly moving up and down the trachea, and impinging against the upper part of the larynx, during an effort of convulsive coughing.

The affection with which this accident is most apt to be confounded, is rapid obstruction of the upper part of the windpipe by inflammatory change. But the history of the two cases must necessarily be very different ; urgent symptoms being in the one case immediate, unaccompanied with febrile excitement of the system, and often most intense at first ; while in the other they are more or less gradual in their accession, of a crescent character, and invariably attended with inflammatory fever. Also, in the accident, expiration is difficult, while inspiration is comparatively easy ; whereas, in the disease, the precisely opposite condition obtains.

That in all cases there is a necessity for the speedy adoption of measures calculated to effect removal of the foreign body, is tolerably plain. Otherwise, the risks to life will be neither few nor slight. 1. Sudden

suffocation may occur, at a very early period, by impaction of the substance in the upper part of the larynx—as already shewn. 2. Imperfect respiration may more gradually induce a fatal issue; in consequence of partial obstruction caused by the foreign body, and accumulation of mucus at the incommoded part. 3. Laryngitis or tracheitis may be excited, of formidable character. 4. Congestion may take place in the lungs; followed perhaps by apoplectic disruptions of the pulmonary tissue, or by pneumonia, or by bronchitis; and it is well to remember, that a foreign body lodged in and irritating the bronchus, may cause fatal disease of the lung—the site of the lodgment itself remaining intact.* 5. A foreign body of small size may perforate a bronchus or bronchial tube, and lodge in the pulmonary tissue; and acting untowardly there, as all foreign substances must, may cause abscess, or lay the foundation for tubercular formation and fatal phthisis. 6. Or the passage outwards may be more advanced. The lungs may be passed through, and the cavity of the pleura reached; and empyema may be the result. No doubt, it has happened that yet another step has been taken; the foreign substance has perforated the walls of the chest, by tedious ulceration, and been discharged externally. And it has also happened that a foreign body has been expectorated by the mouth, along with purulent matter, at a long date from its introduction. But such occurrences are much too rare to warrant their use as precedents in determining the appropriate treatment.

If the violent efforts of the patient fail to dislodge and extrude the foreign body—as is not unlikely—recourse must be had to bronchotomy; and through the artificial opening in the windpipe the foreign body is sought to be extracted. Before proceeding to this operation, however, it is well in cases of comparative obscurity to explore the pharynx and gullet, in the first instance. Urgent symptoms of dyspnœa, we have already seen, may be caused by foreign substances lodged in either of these passages; thence compressing, irritating, and obstructing the air passage. And experience has shewn that a foreign body, not bulky enough to cause dangerous compression, may lodge near the rima, and exterior to it; may cause many of the ordinary symptoms of a foreign body within the windpipe; and that in such a case, while bronchotomy must necessarily fail, expulsive efforts, duly aided by the surgeon, are most likely to succeed.†

Also—in children especially—when the lodgment of a small round substance, such as a pea, is suspected, and when much bronchitic secretion is oppressing the chest, it is well to premise full vomiting, by means of ipecacuan. Along with the vitiated mucus, the offending body has sometimes been expelled.

When the foreign body is of small size, and plainly indicated by the symptoms to be either loose in the air passage, or fixed in the upper part of the larynx, laryngotomy may be had recourse to. It is of easy performance; and, though an aperture through the crico-thyroid space be necessarily of limited dimensions, it is probable that through that space such a foreign body may be readily enough removed. In all other cases,

* Monthly Journal, November 1852, p. 449.

† Lancet, 1069, p. 729.

however, tracheotomy, though a more troublesome operation, is for obvious reasons to be preferred ; the aperture is more free, and the facilities for extraction, both from below and from above the opening, are manifestly greater.

When the foreign substance is loose, it is usually expelled forcibly by the outward current of air, so soon as the operation is completed. On this account it is well, if the patient has been put under the influence of chloroform, to permit him to emerge before opening the trachea, so as to secure as complete efforts at expulsive coughing as possible. If the foreign body is fixed, it must be sought for, and removed artificially. If lodged above the opening, a common probe, or the little finger of the surgeon, is the most convenient instrument for exploration. By it the site is detected ; by it the foreign body may be pushed through the rima—to be coughed up ; or loosening is effected, with subsequent expulsion through the tracheal wound. When the site of lodgment is in the bronchus, forceps somewhat longer than nasal polypus forceps, but a little more curved at the extremity, will be found most suitable for both exploration and extraction. Auscultation and percussion having previously imparted to the operator a shrewd suspicion of the site of lodgment, the instrument is passed down shut, and made if possible to impinge on the foreign substance ; then, slightly withdrawn, the blades are opened ; and pushing on again gently, the object is probably grasped ; if not, their blades should be opened in various directions, so as to catch the foreign body between the blades. The wound is kept open, until bleeding has ceased ; it may then be brought accurately together by adhesive plaster, and adhesion hoped for.

But the air-passage may prove intolerant of the forceps ; and perseverance in their use, searching for a foreign body, might peril life by violent paroxysms of dyspnoea. In such circumstances, chloroform should be administered both by the wound and by the mouth, so as to lull the excessive irritability of the bronchial mucous membrane.* In such cases, modern experience has pointed out a safer mode of procedure†—more especially if the foreign body be of some weight, as a stone, coin, or any piece of metal. The tracheal wound being kept open, let the patient's body be inverted, so as to make the head dependent ; and, if need be, let succussion over the centre of the back be had recourse to, so as to favour dislodgment of the offending substance, and its descent towards the larynx by gravitation. Arrived at the rima, it will not find its outward passage there obstructed by spasm, nor will a paroxysm of dyspnoea be induced ; for, the opening in the trachea has the effect of obviating this difficulty and danger. Escape occurs into the mouth, and thus extrusion is effected with both ease and safety.

It has been proposed to supersede bronchotomy altogether, by the preceding manœuvre. But such a proposal does not seem to be a prudent one. In most cases the attempt would probably fail, and life be imminently perilled, the foreign body being obstructed by spasm at the rima, and perhaps becoming impacted there. The proceeding is suitable only when the foreign body is small, smooth, and of high specific gravity ;

* See a case by Dr. Johnston of Montrose, *Lancet*, No. 1478, p. 600.

† *Lancet*, 1063, p. 502.

and seems to be in all respects safe, only when a tracheal aperture has previously been established ; and when, in consequence, irritability of the rima has been assuaged, and accident by impaction there fully provided against. A case or two of accidental success* will not suffice to overthrow the general principle here inculcated. This procedure, so far as avoiding the occurrence of laryngeal spasm, and consequent arrest of the foreign body at the rima glottidis, might be more satisfactorily and safely effected by having the patient deeply under the influence of chloroform before his inversion.

It may happen that some considerable time—weeks or months—has elapsed since introduction of the foreign body, before aid is requested. Such lapse of time need not deter the surgeon from operating, if other circumstances prove favourable. For experience has shewn that removal of the offending matter, even at a distant date, may be sufficient to avert all serious ulterior consequences.†

Asphyxia.

In attempting resuscitation from asphyxia, it is necessary to maintain artificial respiration ; and this is effected, in ordinary cases, by insufflation of air through the mouth or nostrils. But were the rima glottidis spasmodically closed, such ordinary means would be likely to inflate the stomach only, leaving the lungs unaffected. Under such circumstances, therefore, one of two proceedings is necessary ; to pass a tube into the windpipe from the mouth ; or to perform bronchotomy. The operation of passing a tracheal tube is always difficult ; and becomes especially so, even in an insensible patient, if the rima be closely shut—as in the case of suffocation by carbonic acid. It can readily be understood, therefore, how in many cases such an attempt is well superseded by the operation. Usually laryngotomy will suffice. One caution must be particularly attended to ; namely, to prevent blood from entering by the wound, and accumulating in the air passages. And should such entrance have been effected, means should be taken, by suction applied to the wound, to accomplish its expulsion.

In cases of *Suspension* by the neck, it is plain that bronchotomy cannot avert a serious result, and may probably fail in the attempt at resuscitation. For, the cause of death is not from constriction of the windpipe only ; but by concussion of the brain and spinal cord, and by interference with the jugular circulation. And these latter circumstances may of themselves be sufficient to produce a fatal issue, independently of direct interference with respiration. Displacement of the cervical vertebræ seldom occurs from this cause.

Injuries of the Hyoid Bone and Larynx.

The hyoid bone has been fractured by the pressure of the rope in hanging, by grasping the throat between the thumb and fingers in gar-

* Northern Journal, Feb. 1845, p. 220.

† London and Edinburgh Medical Journal, August 1842, p. 722 ; and Liston's Practical Surgery, p. 371.

rotting, by blows, by falls upon the front of the neck ; and in one case, it is alleged, by the muscular efforts elicited during violent coughing. In the cases mentioned by Mr. South (Chelius' Surgery), where the injury was found in three persons executed by hanging, the fracture existed in the body of the bone ; but in most cases the fracture occurs at the junction of the cornua with the body. In such cases there is always more or less swelling and ecchymosis of the neck ; sometimes hæmoptysis, and pain in moving the tongue or when pressure is made over the cornua of the bone ; while, with the finger inserted into the throat in front and to one side of the epiglottis, the thumb or other hand supporting the parts externally, the mobility of the cornua and crepitus can be recognised. Some surgeons recommend that this fracture should be treated with the neck extended, some with the neck bent ; the patient should be confined to bed ; silence should be enjoined ; and mastication and deglutition should be avoided as much as is possible.

Fracture of the Laryngeal Cartilages.—Such an injury is a rare one, and has usually occurred in aged persons in whom ossification of the cartilage has taken place ; the fracture can easily, however, be produced artificially in the unossified adult larynx in the dead body. The causes which, in narrated cases, have produced this accident, have been blows, garrotting, hanging, a kick from a horse, and falls in which the neck has come in contact with a projecting body. In all such cases, pain, discolouration from ecchymosis, loss of voice, cough, difficulty in respiration and in deglutition, with crepitus on manipulation, have been manifest ; in some, bloody expectoration and emphysema of the neck have also occurred. The risk is from the immediate or ultimate interference with respiration which such an injury must entail. This may be produced by displacement of the broken fragments, by extravasation of blood, or by inflammatory accession.

The *Treatment* should consist in repose of body and part, in the use of cold applications, which will check both hemorrhage and inflammatory seizure, and in a speedy resort to tracheotomy, should the embarrassment threaten to prove fatal. When much displacement is manifestly present, it has been recommended to lay open the larynx and arrange the shattered fragments. Should the inflammatory process set in, anti-phlogistics should be enforced.

A blow on the larynx may directly peril life by arresting respiration. The rima glottidis may be wholly shut, either by spasm of the occluding muscles, or by paralysis of their antagonists—more probably by paralysis of all the muscles concerned ; or it may be but partially occluded, yet with such a tumult and difficulty of respiration as to render the case one of great and immediate hazard. And, under such circumstances, it is plain that the only prospect of relief is by tracheotomy—opening the windpipe below the injured part ; the aperture being kept patulous, until the organ has recovered, and is able to resume its wonted functions in normal respiration.

Rupture of the trachea, by external injury, may prove fatal, by rapid and extensive emphysema ; the pressure of this producing asphyxia more or less rapidly. Sometimes by violent straining efforts with the glottis closed, and the chest suddenly compressed, one of the intervals between

two tracheal rings gives way, and a like result ensues. Accoucheurs have, occasionally, opportunities of meeting with this lesion as a complication of the maternal efforts during the pains of labour. By making many and early punctures in the affected part—or by incision—we may give an outward escape to the air, and so avert threatened disaster.

Hernia Bronchalis.—A rare affection, so called, has been observed in those who habitually strain the throat in loud and sustained calling. A fold of the lining membrane is protruded outwards between two tracheal cartilages; and thus a greater or less tumour, soft and compressible, is formed, according to the extent of protrusion. The only remedial means advisable are such outward applications as are likely, by affording external support, to oppose further enlargement. And the exciting cause—straining of the throat—is, of course, to be discontinued.

Apoplexy of the larynx may occur; blood being infiltrated copiously beneath the mucous membrane. Symptoms may be urgent, simulating croup or cedema glottidis, and so threatening asphyxia as to render relief by bronchotomy inevitable.*

The Accidental Swallowing of Boiling Water, Acids, or other Irritant Fluids.

It is common, among the poorer classes in some localities, to have but one vessel, a large kettle, to hold water for culinary purposes—sometimes cold, at other times hot, according to circumstances. A child, accustomed to have its thirst assuaged from such a source, is likely to help itself, when no one else is near; and, in doing so, may unhappily fill its mouth with water of a boiling temperature. Instantly an attempt is made by the little sufferer to eject the fluid; and in the backward movement of the hot water, partial entrance into the open rima glottidis is not unlikely to occur, during the expulsive paroxysm. The result is a scalding of the air passage, as well as of the pharynx and upper part of the œsophagus; and by swelling in the former situation, during the subsequent inflammatory process, the most serious results may ensue.

Adults may swallow acids or other acrid fluids, either by accident or intentionally. In the latter case, the air passage is seldom injured. The determination to the act of swallowing shuts the glottis, and the fluid passes downwards in the gullet alone. But if a patient accidentally attempt to swallow a fluid of this kind, mistaking it for some other of a harmless nature, the expulsive effort is instantly made—as in the case of the child with hot water; the glottis is opened in the paroxysm, and the noxious fluid effects a partial entrance there.

The treatment of such cases requires to be conducted with an energy proportioned to the urgency of their nature. The inflammatory process cannot be prevented; but it should be our anxious endeavour to moderate and delay its onset, and to effect its speedy retrocession. The most active antiphlogistics are employed—immediately; bleeding from both part and system; outward fomentation; antimony. It may be that by such means the progress of inflammatory tumescence may be

* Monthly Journal, August 1847, p. 126.

restrained, so as not to affect respiration urgently, and that inflammatory extension from the parts first involved to the air passages in general may be prevented. If, however, antiphlogistics fail, and asphyxia threaten by obstruction in the larynx, tracheotomy is to be had recourse to ; at once ; not reserving the operation, especially in the child, until by extreme urgency of the symptoms it cannot possibly be longer delayed, and recovery is rendered more than problematical by congestion in the brain, in the lungs, or in both. Laryngotomy is plainly unsuitable ; to practise that, would be to cut into the affected part, and to fulfil very imperfectly, if at all, the object of the operation. The wound of tracheotomy, on the other hand, is below the seat of disease, the affected part is put at rest, life is saved from asphyxia, and the inflaming larynx, by being allowed quietude, is powerfully aided in the resolutive effort. On decadence of the inflammatory process, and when absorption, clearing away all swelling, has restored the normal state of the organ, the tube is withdrawn, and the wound permitted to close. By too long delay cicatricial contraction may occur, or permanent thickening remain, so as to prevent the patient afterwards being able to breathe without the tracheal wound remaining open.

Spasm of the Glottis.

It has been already stated how bronchotomy may be highly available in the case of spasmodic closure of the glottis, threatening asphyxia ; as in poisoning by carbonic acid.

Laryngismus Stridulus, a spasmodic affection of the windpipe, not uncommon in children, and occasionally met with in the adult, may in its paroxysms threaten suffocation ; and, in such circumstances, the question of the expediency of bronchotomy comes to be entertained. In general, the operation is to be withheld, unless the circumstances prove extremely urgent ; and it is then employed as a means of palliation and protraction, rather than of cure. And more especially will the prognosis be guarded and unfavourable, if there be reason to believe that the spasmodic attacks are dependent on irritation produced by structural change at a low part of the windpipe ; as by enlargement of the thymus gland, affection of the bronchial glands, aneurism, or other formation of tumour. In one form of aortic aneurism, when the tumour is small, and does not compress and contract the air passage, but acts on the larynx irritatingly by implication of the recurrent nerve, causing suffocative paroxysms of spasm in the glottis, it seems very proper to have recourse to tracheotomy early, with a certain hope of relief, and a prospect of even something more than mere palliation. But when the tumour is large, compressing and contracting the air passage, and causing continuous dyspnoea, which involves both inspiration and expiration, the prospect is not so favourable, and the grounds for operation are scarcely sufficient, probably, to warrant its performance.* Even in such cases, however, it has been recommended to operate, and introduce a long elastic tube of such size as the trachea at the site of obstruction will admit, which shall be carried beyond the situation of the aneurism. This proceeding must be attended with manifest

* Monthly Journal, Aug. 1851, p. 185. *Ibid.*, Feb. 1853, p. 114.

risk of lacerating the thinned coats of the trachea and aneurism, and inducing an immediately fatal result.*

Laryngoscopy.

In examining the larynx with a view to determine the existence of structural lesions, their nature and curability, and even in some cases to effect their operative treatment, great assistance will be obtained by the use of the laryngoscope.

The idea of the employment of such an instrument, in the diagnosis of affections of the glottis, first occurred to the fertile mind of Liston, who in 1837, in his *Practical Surgery*, wrote as follows: "By such a glass as is used by dentists on a long stalk, previously dipped in hot water, introduced with its reflecting surface downwards, and carried well back into the fauces, a view may often be had of the parts." This hint, of fully twenty years' standing, was in 1855 turned to good purpose by Garcia, who, in the *Philosophical Magazine and Journal of Science* (vol. x. p. 218) for 1855, published a series of observations upon the formation of the voice. In 1857 Dr. Turck, physician to the General Hospital at Vienna, occupied himself in researches upon the diagnosis of laryngeal disease by this means. Since that period the attention of the profession and of physiologists has been directed to the prosecution of the study of diseases, and of the physiology of the larynx, by means of the laryngoscope, chiefly through the active exertion of Dr. Czermack of Prague. By Liston, Garcia, and Turck, the illumination was obtained by the patient sitting facing the sun-light, so that the luminous rays, falling on the little mirror placed in the throat, might be reflected down into the larynx. At the same time the reflected image of the laryngeal apparatus became visible in the mirror to the observer, whose head was so placed as to see without intercepting the light.

For auto-laryngoscopic investigation an additional hand-mirror is required, by means of which, the observer's back being turned to the sun, the light is first reflected upon the laryngeal mirror, and thence into the larynx; while in the hand-mirror he sees the reflection of the laryngeal mirror, with the picture of his own larynx. Although solar light is undoubtedly, in point of brilliancy and colour, far better fitted for enabling the observer to recognize alterations in tint than any artificial illumination can ever be, the latter is more generally applicable for this purpose. When artificial light is employed for auto-laryngoscopy, the observer must sit facing and close to the lamp, with the hand-mirror held so as to screen his eyes from the light which illuminates the laryngeal mirror; while, at the same time, he is enabled to see in the glass of the hand-mirror a reflection of his fauces, and the image formed on the faucial mirror.

The best means of artificial illumination for laryngoscopy is either the common paraffin lamp, or an argand gas lamp. In examining

* It were out of place, in such a work as this, to enter fully into the various interesting and important affections of the windpipe. But it is right to notice them briefly, in connection with the operation of bronchotomy; the leading features only being stated.

patient, the light should be placed close beside his head, and a little behind the level of the face. The reflector for this purpose, instead of a hand-glass, consists of a slightly concave mirror, like a large ophthalmoscope, either held or fastened in front of the observer's face, so that the aperture in the centre corresponds to the axis of vision when he looks into the patient's mouth, and focuses the reflected light upon the soft palate and posterior wall of the pharynx.

The mirror may be supported by being fastened to the observer's head by an elastic frontlet, with ball and socket or rectangular movement; or it may be attached to a stem passing through a wooden or ivory mouth-piece, which is held between the surgeon's teeth; or it may be affixed to a pair of spectacles, or attached to a metal stem or foot-piece which stands upon the table; or, lastly, it may be supported separately by means of a more or less elaborate apparatus composed of sliding rods, and ball and socket joints, screwed to the chair on which the patient sits. Of these the simplest is held by most experienced operators to be very available in all circumstances. But each individual observer will usually find that he has a special preference for one form of mirror-support rather than another, and that with it he works most comfortably.

Having seated the patient, arranged the light and illumination to his liking, the surgeon now desires the patient to open his mouth, and teaches him how to keep the fauces exposed as fully as possible, while the tongue, from base to apex, is depressed below the level of the teeth in the lower jaw. Until a patient has acquired this power of control over the tongue, it is almost impossible satisfactorily to proceed further with the investigation; for although assistance may sometimes be gained in steadying the organ with a tongue depressor or spatula, it is impossible satisfactorily and gently to manipulate with the mirror in the fauces, while with the other hand an unequal struggle is being waged with the tongue. Having secured the steadiness of the patient and of the tongue, the surgeon selects the faucial mirror of as large a size as is suited to the width between the arches of the palate. Having warmed it over the lamp or gas, so as to be pleasantly hot when applied to his own cheek, he carries it into the patient's throat, avoiding the pillars of the fauces, but bearing its upper or back surface against the uvula, and thus backwards, either against or towards the posterior wall of the pharynx. The stem of the faucial mirror will generally be found supported against the lower bicuspid teeth, near the angle of the mouth. The position of the mirror is now altered as is found requisite, being inclined by elevating or depressing the handle; or it is gently rotated. As these movements are effected, the base of the tongue and circumvallate papillæ will usually first become visible; then the epiglottis, standing up in bold relief, and presenting its free margin and posterior or inferior surface, will catch the observer's eye; and then a confused ruddy, dimly-lighted, and irregular surface, which consists of the upper and lower vocal cords, the ventricles of Morgagni, the arytenoid cartilages, and their processes, the cartilages of Wrisberg and Santorini, the aryteno-epiglotticæan ligament—and, in the centre of the lowest part of the epiglottis, the cushion of that part. To distinguish these several textures, the patient should be desired to call his laryngeal mechanism into play; as for

example in the effort at coughing, in sounding a low, and then a high note, in making a partial effort at swallowing, and lastly, in taking several long deep inspirations. During this last manœuvre the glottis is widely thrown open, and with careful management the surgeon can easily recognize the tracheal rings; and in favourable circumstances—which import a steady patient, a good light, a capacious glottis, and perpendicular straightening of the neck—the bifurcation of the trachea can even be observed. In order to acquire facility in manipulating, auto-laryngoscopy should be diligently practised; sun light, a common hand mirror, and the ordinary large-sized and square-shaped faucial mirror being employed. The experimenter should sit with his back to the window, resting his left elbow on a chair, in his left hand managing the ordinary mirror, and in the right manipulating the faucial one. Till he has gained a confidence in his powers of easy recognition of the parts concerned, he need not attempt laryngoscopy on others. He must, however, bear in mind that the image he sees of his own larynx in auto-laryngoscopy is “upright;” while in examining the larynx of his patient, the reflexion in the faucial mirror is inverted, so that what seems *right* is really *left*, and *vice versa*. This is chiefly important in operative proceedings, where this instrument is employed as a means of effecting accurate manipulation. There are no doubt patients, in whom the excessive and persistent irritability of the fauces prevents the introduction of the faucial mirror. In others, at first impracticable, the difficulty may to some extent be overcome by repeated efforts, or by the employment of smaller sizes of mirror, less apt to incommode the arches of the palate. In others, the use of astringent applications, such as tannin or nitrate of silver, to the fauces may be of service; or the throat may be gargled, just before the attempt, with cold or iced water. In some, the bromide of ammonium administered for some hours previously, in large doses, seems to produce a diminution of the faucial sensibility. In others, especially when operative manipulations are to be employed, chloroform may be inhaled with advantage; not, however, carried so far as to induce unconsciousness, but only to act locally on the parts with which its vapour first comes in contact, and thus to dull the faucial, pharyngeal, and laryngeal irritability.

Laryngitis.

The inflammatory process, occurring in the larynx, may be either chronic or acute.

1. ACUTE LARYNGITIS. *a. Laryngitis simplex.*—There is, in this affection, more or less aphonia, from turgescence of the mucous membrane, with the accustomed change of secretion—the results of a minor amount of the inflammatory process. On examination with the laryngoscope, the soft lax mucous membrane may show the swelling diffused uniformly, and not at any part great; or the margin of the true vocal cords and the sinuses of Morgagni may alone be affected, one side often more than the other. When vocalisation is attempted, the parts come irregularly together, and the hissing sound of the voice is obviously due to the incomplete approximation of the arytenoid cartilages and processes permitting too free an escape of air through the chink of the larynx.

There is, however, no interference with the patency of the glottis in the effort at full, deep inspiration ; the secretion, accordingly, is not liable to be retained and accumulated ; no paroxysm of dyspnœa threatening suffocation is likely to be caused by such changes, even when considerable ; and consequently, in this affection the direct interference of surgery, by bronchotomy, is not required. Medical treatment as for cynanche, of which it is a common complication or consequence, suffices.

b. Laryngitis Œdematosa.—This is the acute *Œdema Glottidis* of Bayle and Lawrence,* an inflammatory process attacking the larynx, and rapidly causing much bulging of the lining membrane by serous or seropurulent infiltration of the submucous tissue. In consequence of such change, the characteristic symptoms are soon developed ; increasing dyspnœa, liable to paroxysmal exacerbation ; inspiration protracted, laboured, and stridulous ; expiration comparatively easy and silent ; anxiety of countenance ; rapid, feeble pulse ; venous congestion, or extreme pallor of the face, lips, and skin ; copious transpiration from the surface, with great languor ; and death either by gradually-induced coma, or from sudden asphyxia during one of the paroxysmal attacks. With the laryngoscope the obstruction is found chiefly to implicate the arytæno-epiglottidæan ligaments, the false and true vocal cords, and the sinuses of Morgagni ; the mucous membrane of the epiglottis being also tumid. In many cases, however, when the asphyxia is very acute and intense, the margins and under-surface of the true vocal cords have alone been implicated, indicating that it is change in them which really forms the serious obstacle to inspiration. The œdematous parts have lost their normal pink tint, and present a glistening clear amber aspect, due obviously to the distension of the mucous and submucous tissue with sero-fibrinous product. When the affection implicates the mucous membrane, covering the epiglottis, arytæno-epiglottidæan ligament, and upper part of the laryngeal apparatus, a more plain indication is afforded to the surgeon, inasmuch as the œdematous swelling may be felt, on the epiglottis and glottis, by the finger introduced from the mouth ; and may even be seen, on merely depressing the tongue forcibly by the speculum. Practically, the disease may be divided into three stages. 1. There is the condition of laryngitis simplex ; while the affection has not proceeded beyond turgescence, and when there is no obstruction to breathing. But this state is quickly overpassed, in most cases. 2. The characteristic œdematous swelling is forming ; not diffused and uniform, but mainly affecting the glottis and its immediate neighbourhood, and causing prominent bulging there. Respiration is now more or less impeded ; and obstruction is on the increase. 3. Breathing having been for some time seriously interfered with, and aëration of the blood imperfectly performed, untoward results begin to manifest themselves in both lungs and brain—congestion, followed by serous accumulation ; and the threatening of asphyxia is aggravated by the approach of coma. Most frequently the obvious cause of death is by the former event ; obstruction by mucous swelling becoming greatly augmented by the accumulation of viscid mucous secretion, which the inefficient efforts at coughing cannot relieve ; a

* BAYLE, Mem. de l'Acad. de Chirurg. LAWRENCE, Med. Chirurg., trans., vol. vi. 1815.

paroxysm of dyspnœa is induced ; in the tumultuous disorder of respiration that ensues, it is not improbable that the patient may drop asphyxiated ; and recovery from that state will be seriously affected by the cerebral change already in progress. In other cases, the fatal issue is more gradual ; asphyxia steadily advancing, without paroxysmal aggravation. The causes of this affection may be idiopathic or traumatic. It may come on from an inflammatory seizure due to cold affecting the larynx, it may be an extension of a tonsillar affection—of a simple, or specific-inflammatory, or cancerous nature. It may also be induced by wounds, bruises, or fractures of the laryngeal apparatus ; or by the sting of a bee or wasp, during deglutition, which has been hidden in a mouthful of fruit ; and we have seen that the imbibition of caustic or boiling water has frequently caused it in an aggravated form.

The suitable treatment is active throughout. At first ordinary antiphlogistics are plied industriously ; blood-letting, antimony, calomel and opium. These may arrest the affection in its first stage. If not, let them be persevered with ; for they may yet mitigate the swelling, prevent the occurrence of urgent symptoms, and procure a favourable resolution from the second or characteristic stage, without life having been ever seriously endangered by threatened asphyxia. In this stage, however, be it remembered, blood-letting must be had recourse to with very considerable caution ; it being well known, from experience, that there is an intolerance of this remedy, heroically employed, in all cases in which respiration is seriously obstructed. Let mercury take the place of loss of blood ; and by it, judiciously employed, let us hope to limit product and promote absorption successfully, and thus to make a satisfactory impression on the œdematous bulging. Not seldom, marked benefit will follow free scarification of the epiglottis and lips of the glottis, by means of a curved knife ; the laryngoscope being used to guide its blade, or the tongue being fully depressed by the mouth-speculum, so as to render these parts accessible to such procedure. Should, however, resolution fail to follow on the use of such means—the symptoms proving both crescent and grave—let bronchotomy be at once had recourse to ; regarding the operation as truly a part of the remedial treatment, whereby the peril of extreme urgency may be avoided, not as a last resource whereby a life half lost may only perhaps be regained. Tracheotomy is plainly to be preferred ; for thus only can we place the artificial opening beneath the seat of obstruction, so as to effectually avert the immediate danger by impending asphyxia ; and thus only can we fulfil the very important indication of placing the affected part in the state of comparative quietude and repose, so suited for facilitating resolution and recovery. The medical treatment is not interrupted meanwhile. In due time it tells favourably on the swelling. This begins to subside, and then the use of the tube may be begun to be discontinued, introducing it only occasionally. Ultimately the part recovers itself wholly as to swelling ; and then, the tube having been fully withdrawn, the wound is approximated and encouraged to heal. During the first hours of the tube's use, great care is necessary in keeping the aperture clear ; viscid mucus is being copiously secreted ; the power of expectoration being very weak, occlusion of the artificial rima is apt to ensue ; and such risk

by sudden asphyxia is all the more likely to occur, if the patient have fallen asleep shortly after the performance of the operation—as often happens. More than one day and night may have been passed in sleepless anxiety, pain, and distress ; and the relief at once experienced, after the first effects of the tube's introduction have passed away, is apt to lull the relieved sufferer into a deep and unconscious slumber—from which it were hard to be awakened, abruptly, only to perish by suffocation. This risk is greatly diminished by employing a double tracheotomy tube ; the inner one longer than the outer, and so constructed to slip readily within the outer, that the qualified attendant, who must be in constant surveillance, can easily maintain clearance of the tube by removing it from time to time, and carefully washing and clearing it out by means of a piece of bandage soaked in water, till its patency has again become complete. This must be carefully attended to until the excessive secretion of mucus has diminished, and the power of expectoration been regained.

In this affection, then, let tracheotomy be had recourse to, so soon as it is plain that medical treatment has failed to effect timeous resolution. Do not delay, until both lungs and brain have been so far involved, by the persistent dyspnœa and the frequently repeated paroxysms, as to render recovery under any treatment at that stage more than doubtful.

c. Laryngitis Fibrinosa is usually combined with a corresponding morbid state of the trachea—*tracheitis fibrinosa*—constituting *Croup*. This inflammatory affection of the larynx is proper to infancy and childhood, occurring most frequently between the ages of a few months and seven years, more rarely between seven and fourteen, but occasionally met with up to twenty-one years of age. The latter periods, however, may be regarded rather as liable to attacks of œdema glottidis ; and we may very reasonably suspect that often a mistake has been made in including these cases under the name of croup. The disease rarely occurs in well-clothed and carefully-tended children, unless there has been undue exposure of them, as by sitting on damp grass or under trees. A residence in damp, ill-drained, low-lying parts of town or country, and the occurrence of scarlatina, erysipelas, or small-pox, may all be assigned as causes for its access. The symptoms usually come on at night. The child has been put to bed, sleeps soundly for an hour or two, but becomes feverish and flushed, while quick noisy breathing and a tickling cough disturbs his rest ; perhaps the cough becomes noisy and barking, and the sound of the cry or voice hoarse. Sometimes these symptoms again subside in the morning, but the child is languid, peevish, fretful, thirsty, and lacking his accustomed appetite ; at night the laryngeal cough returns, and the uneasiness which the child suffers seems to proceed from the throat and chest. The breathing becomes quickened, noisy, and stridulous, the fever increases, and the anguish and oppression of the chest become paroxysmally aggravated, so that the child cannot lie, and will sit up or be taken in his nurse's arms. The sound of the voice becomes crowing or hissing in tone, and the cough now possesses a clear ringing sound. The lips and tongue become dry and parched, the eyes watery and staring, the veins of the head and neck bulging, the face puffy and livid, the pulse quick and feeble ; the chest expands very partially, the lower ribs being usually sucked in with each

effort at inspiration ; and now the child either dies suddenly asphyxiated in a convulsive attack during the spasms, or the efforts at respiration grow gradually feebler—the nostrils, however, expanding widely at every inspiration ; the face grows more pallid, the pulse quicker, the eyes heavy and expressionless, the pupils dilated, coma becomes complete, and the child dies exhausted. The unequivocal symptom of the disease is the exspitation of false membrane, in shreds or moulds of the larynx, trachea, or bronchi ; and this is sometimes attended with very great, but only temporary, relief. The disease runs its fatal course very rapidly, a few days at farthest being its limit ; sometimes, in fact, after a few hours, in a very young child, the symptoms will have advanced so far as to render recovery almost impossible. For practical purposes, there may be a convenient division into three stages. 1. The laryngitis simplex, but of greater intensity than in the case of *œdema glottidis*, and with a marked tendency to spread along the mucous membrane downwards. 2. The fibrinous formation begun ; aggravating all the symptoms, and affording serious obstruction to breathing. 3. The lungs and brain implicated, as in the former case, by reason of the continuance of impeded respiration. The lungs, however, in this case, are exposed to an additional source of danger. The inflammatory process, by continuous extension, may have reached the bronchial ramifications ; and to the oppression of the lungs' play, otherwise occasioned, the additional and serious complication of bronchitis may be added.

In the first stage, medical treatment is practised ; a smart emetic, a warm bath, and repeated hot poultices, with turpentine, applied to the throat and chest, being of more service than anything else. Blood-letting is ill borne, counter-irritation by blistering is too tardy, and the continued use of calomel, antimony, or sulphate of copper, is so depressing, that in many cases where they apparently have proved serviceable in checking the progress of the laryngeal symptoms, they have induced so much gastro-intestinal irritation as to determine a fatal result. At this period there is no demand for tracheotomy on account of urgency of symptoms connected with respiration ; and the spreading acute inflammatory process is not likely to be limited in either its extent or intensity, by the infliction of a tracheal wound, and retention of a foreign body therein. In the second stage, the symptoms are sufficiently urgent to call for any aid which our art can afford. Tracheotomy will give a more direct and free entrance for air passing towards the lungs, than through the affected larynx ; and the larynx will be placed in a state of comparative rest, favourable to recovery. But the same good result does not follow as in the case of acute *œdema glottidis*. In croup, unfortunately, the disease is not limited to the larynx, but has often passed the site of tracheal wound, and is already established in the bronchial tubes ; the wound is made—not in a comparatively sound part, to afford rest to the superior portion of the canal—but in the midst of the disease, affording rest to but a part, and perhaps a minor part, of the disorder's seat, and possibly inducing, by its additional stimulus, an aggravation of the whole. Air is let in towards the lungs, but with only a doubtful chance of reaching them ; for by this time the bronchial tubes may be clogged with viscid mucus, while certainly the bronchial membrane is itself swollen and infiltrated,

the trachea may be more or less obstructed by false membrane, and perhaps, indeed, pseudo-membranous formation may have extended throughout almost the whole bronchial ramifications. When the third stage of croup has set in, tracheotomy must prove only exceptionally a means of restoring the patient. In this disease, therefore, the practical inference from such considerations will be, that in the first stage our principal confidence must be placed in medical treatment. When, however, the second stage has set in, in spite of medical efforts to check the progress of the disease, the question arises, Shall we perform, or shall we not resort to tracheotomy? This question has been very differently answered by the experience of different surgeons. By some it is considered as a desperate attempt to save life, and therefore not justifiably undertaken so long as medical treatment holds out a shadow of a hope of checking the disease. By others, a great success in the employment of tracheotomy in cases of supposed croup has led them to resort to its performance in every case, whenever the respiration becomes seriously interfered with, whatever the stage of the disease—so long, in fact, as the little patient is struggling ineffectually for breath and not actually moribund. To the latter class of practitioners we incline to belong, and hold that the surgeon should unhesitatingly undertake the operation whenever the dyspnoea is urgent, sustained, and accompanied by drawing in of the lower part of the chest on inspiration, with recurring paroxysmal attacks, a rapid pulse, becoming feeble, a congested or a pallid and leaden aspect, with turgid veins and copious perspiration. If the operation is not performed under such circumstances, death may ensue during the next paroxysm; or if it be delayed longer, the delay is sure to induce œdema of the lungs, to increase the likelihood, therefore, of congestion or actual stasis of the pulmonary circulation, to exhaust the heart by its inability to force onwards the blood accumulating on the right side, and lastly, still further to diminish the powers of life by the persisting dyspnoea, and the continuance of depressing treatment, so that the little chance becomes no chance at all when tracheotomy is performed at a later period. No doubt the tube and wound in the trachea may be causes of bronchitis; but certainly impending asphyxia, œdema of the lung, and its consequences, and exhaustion of the patient, are far more likely to act injuriously in determining not only bronchitis, but also collapse of the lung, if permitted to continue till a fatal issue is obviously threatened. No doubt, also, the false membrane may extend beyond the tracheal opening; that, however, does not preclude its exspitation, after tracheotomy, any more than before; nay, it saves the patient from the risk of the shreds or casts becoming impacted in the glottis, and thus inducing instantaneous death. But experience proves furthermore that where it does not save the little patient from death, it alleviates his sufferings; affording him respite from struggling efforts, at a small expense of temporary additional pain, while it stills the hoarse cry and the barking cough which have, during the



Fig. 297.

Fig. 297. Example of false membrane, in croup. Its evil consequences very apparent.

weary watch, been so sore a trial to his anxious friends. In undertaking the operation, the surgeon should satisfy himself as to the condition of the chest; seeing that the want of expansion acts equally on both sides, that the respiratory murmur—not the hoarse and shrill rhonchus communicated from the larynx and consonating through the bronchi of the lung, but of the air entering both lungs—can be heard, and that there is no dulness on percussion at either base. His duty then is plain. He should perform tracheotomy as speedily as possible. The operation may not save his patient, or the case may not be one of true croup, but certainly nothing else will help the sufferer, whether the case be croup or not. The question still remains, Where should the operation be performed? If laryngotomy be chosen, we open the air-tube certainly above the seat of the membranous formation. The same objection holds good in regard to the supra-thyroid operation, by which we open the trachea. The membrane, probably, may extend lower down; though, as Home, one of the first and best writers on this affection, has remarked, “The place first and most particularly affected is the upper part of the trachea, about an inch below the glottis.” We, therefore, prefer the deeper and more difficult operation of opening the trachea immediately above the sternal notch, and below the isthmus of the thyroid gland. The after treatment of these cases in children of tender age constitutes one of the most important elements in the success of this operation. The duties of the nurse or attendant should consist in watching the breathing, keeping the

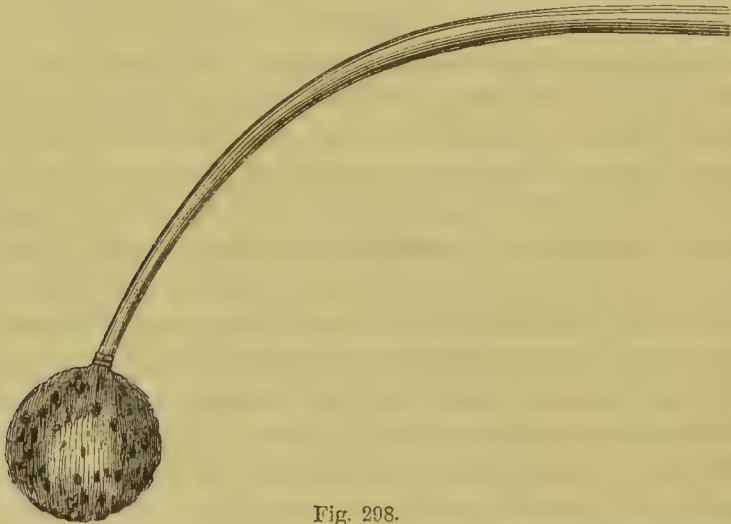


Fig. 298.

tube clear, maintaining an equable warmth and moisture in the atmosphere of the apartment, and in stimulating the system, or depressing inflammatory reaction in the pulmonary organs, as the pulse and aspect of the patient seem to indicate.*

* Trousseau and Bretonneau warmly advocate the performance of tracheotomy in croup, and support their doctrine by an array of successful cases (*Brit. and For. Rev.*, No. 23, p. 110). On this point, however, the question must always obtrude itself—Were these cases all examples of true croup? For it is well known how loosely medical nomenclature is often applied; and as, by some, all sores on the penis are

Fig. 298. End of the sponge-probang, for the larynx; the sponge always carefully affixed to whalebone not made brittle by the caustic.

The direct application of nitrate of silver, in strong solution, to the affected part, has been advocated by Green of New York and others, as productive of benefit in the early stage of this disease. By means of a powerful spatula, the tongue is depressed and brought forwards; a bent piece of whalebone, tipped with sponge, and soaked in the solution (from two to four scruples of the salt to the ounce of distilled water) is passed behind the epiglottis, and then suddenly forced down upon the top of the larynx. Dr. Hamilton of Falkirk has recently recommended for this purpose a piece of small-bore caoutchouc tube, about a foot long, open at both ends, and attached to the curved whalebone larynx probang, so as to follow its curve, and project beyond it. This is dipped into the caustic solution, the proximal extremity of the tube is then compressed by the right forefinger against the whalebone handle, and after a good view of the epiglottis has been obtained, the distal point of the india-rubber tube is directed immediately over its apex; the patient, in obedience to the surgeon's command, then attempts to take a deep breath, the controlling pressure on the tube is removed, and the solution, escaping suddenly, takes the glottis by surprise, and passes into the trachea. Unfortunately, in croup, the plan of treatment by the application of nitrate of silver has not been found satisfactory; the small size of the larynx and trachea rendering a very slight cause of obstruction amply sufficient to induce asphyxia.

d. *Diphtheria*, or *Cynanche membranacea*, usually commences, as we have already seen, in the fauces—generally on one or both tonsils—and, extending to the pharynx, may also affect the larynx. The disease is apparently a mere local manifestation of a constitutional condition due to septic influences, generally traceable to foul drainage. The implication of the larynx is rarely met with in the early stage of the disease; more usually when it is further advanced. In the early stage, if laryngeal dyspnoea manifests itself, tracheotomy may be had recourse to with as good a prospect as in croup. In the later stage, the advanced period of the affection implying weakness of system, and therefore feeble powers of bearing up under operative treatment, the prognosis becomes unfavourable; but, further, the paralysis consequent on diphtheria, which we so commonly observe affecting the muscles of the palate, the ciliary muscle of the eyeball, and even the muscles of the limbs, sometimes implicates those of the glottis as well, rendering them incapable of resisting the entrance of foreign bodies into the larynx. A fatal result from this cause has more than once been observed to carry off a patient, on whom an apparently satisfactory tracheotomy had been performed, the fluid passing the glottis and tracheotomy tube, and not being expelled through the latter in sufficient quantity to prevent suffocation. In such circumstances a feeding tube should be passed, and through it all nutriment should be conveyed to the stomach till the glottis resumes its function.

e. *Laryngitis Purulenta*.^{*}—Such a result is of comparatively rare occurrence; and fortunately also, when it does occur, the affection is usually called chancre, all hard swellings on the breast dignified by the appellation of scirrhus, every suspicious fungus called fungus hematodes—so may all acute affections of the larynx be arranged under the general denomination of croup.

^{*} London Medical Gazette, January 12, 1833.

confined to the upper part of the larynx, and corresponding portion of the fauces. The matter is not limited in the form of abscess, but is diffusely infiltrated into the submucous areolar tissue. The membrane gives way, the matter is discharged, and an ulcerated surface remains. The symptoms and progress are, in the first stage, those of simple laryngitis, acute or chronic. In the suppurative stage the pain is increased, especially on pressure over the larynx, and the uneasiness in respiration may become extreme, while the voice is completely, or almost completely, destroyed. These symptoms are relieved by the escape of the matter, indicated by the expectoration of pus along with blood and mucus. This result having been attained, the inflammatory affection may subside, or ulceration may obstinately progress; either simply involving the mucous membrane, or destructively invading the muscles, cartilages, and their ligaments as well, attended with expectoration of portions of them, or if it has extended downwards, of the tracheal rings also. After this the expectoration may gradually diminish, the breathing become restored nearly to its normal condition, and the voice more or less completely recovered; or, the disease maintaining its ground or extending, one form of phthisis laryngea becomes established. The treatment in its early stage is that of acute laryngitis. As the suppurative result is attained, the dyspnoea may demand tracheotomy, which will not only afford relief, but act as a remedial agent in putting the larynx at rest for a time, and thus affording facilities for a complete restoration of this organ. When the purulent expectoration is excessive, and if blood more particularly is mixed with it, tonics, cod-liver oil, and the local application of the nitrate of silver solution by means of the probang, hair pencil, or tube, should be had recourse to, with the application externally of blistering tissue.

II. CHRONIC LARYNGITIS.—This may be the result of an acute or subacute attack; more frequently it is chronic from the first. But, however originating, it is ever liable to sudden and acute aggravation, from comparatively slight causes; bringing life into peril—all the more imminently on account of the insidious and comparatively mild nature of the previous symptoms.

a. Thickening of the Mucous Membrane, resulting from what may be termed Simple Chronic Laryngitis, or from condylomatous thickening of the mucous membrane, in which the ulcerated or thickened tubercular-like patches can easily be recognised by means of the laryngoscope, usually gives way to remedial treatment alone; leeches, counter-irritation, mercury, and other alteratives. Should an acute accession supervene—and to such the patient is constantly liable—obstruction to respiration may be speedily induced, threatening the most serious consequences. Under such circumstances, proportional augmentation of the medical treatment may fail to relieve; and then tracheotomy comes to be required.

As a general rule, when counter-irritation is employed in any affection of the larynx, it should be applied either laterally, or on the back of the neck, not in front. For, the remedial effect is the same; and it is obviously expedient to leave the site of tracheotomy clear and available, in the event of recourse to that operation becoming necessary.

b. Follicular disease of the larynx is an affection of great frequency; the disease being resident and in most cases originating in the mucous

follicles. These are seen on the back of the pharynx, in various stages and forms of morbid alteration—hypertrophied, vesicular, pustular, ulcerated; and the presence of similar change within the larynx is marked by characteristic symptoms—cough, expectoration, hoarseness of voice, etc. This affection is particularly liable to occur in public speakers and clergymen; hence the term "*dysphonia clericorum*," in which, along with all other chronic affections of the larynx, this disease is classed. If permitted to advance, the consequences are serious; loss of voice, increase of structural change in the air passages, and impairment of the general health. Treatment consists in rest of the parts; application of the nitrate of silver, in the manner already described, both to the fauces and within the larynx; and alteratives internally, according to circumstances—arsenic, iodide of iron, Donovan's liquor, etc. Should the circumstances of the patient admit of it, a residence for one or two winters in Italy, Egypt, or Syria, will usually do more than any medicinal treatment to restore the parts to their normal condition.

c. Chronic Œdema Glottidis.—This affection is more gradual and less marked than the acute form; but is not less dangerous; being liable to sudden and great exacerbation. The œdema is gradually formed, of more solid consistence, and more uniformly diffused. But from slight exposure to cold, error in diet, or other casualty, acute accession is very prone to supervene; speedily blocking up the passage, and causing the most distressing and dangerous dyspnoea; partly by acute swelling, partly by entanglement of viscid mucus, partly by spasmodic or otherwise disordered action of the muscles of the larynx. Sometimes, without any apparent source of aggravation, a fit of dyspnoea suddenly occurs; dependent, probably, on the last-mentioned cause—spasm. Such a patient is never secure. One moment he may be walking abroad, conversing, or otherwise enjoying life with tolerable comfort; the next he may be prostrate, livid, and struggling for existence. A fatal result, however, seldom follows the first of such seizures. Minor attacks usually precede the fatal event.

The duty of the practitioner is, by suitable treatment, to arrest the sluggish process, to undo the change of structure, and to restore tone to the enfeebled system; and, by every care, to provide against the application of such causes as are likely to induce aggravation. Should such aggravation occur, he must be on the alert. Medical treatment is continued, with redoubled care and anxiety; and the patient is closely watched. If the treatment prove unsatisfactory—fits of dyspnoea continuing to recur—tracheotomy is certainly to be performed. Thus only can the tenure of life be rendered at all secure in such cases; and then, too, the other remedial means may be expected to have a more salutary effect on the original disease—as in the case of simple thickening. After some time, the tube may be withdrawn, and the wound closed. However, prognosis as to discontinuance of the tube is not so favourable as in the acute form. Resolution may be slow and imperfect; the part may never wholly regain its normal state; perhaps respiration cannot be restored through the normal passages; and the tube, consequently, may require to be worn during the remainder of life.

d. Ulceration of the Larynx.—The larynx is liable to ulceration of

different kinds—the result usually of a chronic inflammatory process : 1. *Simple ulceration* may occur as a direct result of acute or chronic laryngitis, or of follicular disease ; or the larynx may be implicated secondarily by extension of ulceration from the fauces—as is not unlikely to happen in patients who have the misfortune to labour under an aggravated form of syphilis. The ulceration is very liable to be surrounded by œdematous swelling, which, by obstructing respiration, seriously complicates the case, and may demand both instant and energetic measures to save life. And such complication is especially apt to occur, if by exposure, or other cause, an inflammatory aggravation have supervened on the previously chronic form. Or the amount of œdema may be slight, respiration may never be seriously impeded, the ulcer may heal, and the normal calibre and function of the larynx may be almost wholly restored. Or, on cicatrization—long delayed—contraction and displacement of the parts are such, as permanently to interfere most seriously with both voice and respiration.

Treatment consists in constitutional alteratives, suitable regimen, careful protection from all sources of aggravation, patient continuance of moderate counter-irritation, and regulated use of nitrate of silver to the affected part ; and thus we hope to effect cicatrization, ere dangerous loss of substance has occurred—to effect, in short, something like actual resolution. If œdema supervene, and life be threatened by paroxysmal dyspnœa, tracheotomy is imperatively demanded, and must be performed. At this juncture, it is indispensable to the preservation of life. But it comes to be a question, whether its earlier employment may not be expedient ; not to save life, directly, but to save structure ; by placing the larynx at rest, and so facilitating the action of remedial means—accelerating cicatrization while ulceration is yet both limited and superficial, and thus preserving unimpaired the important function of the organ. I would incline to the opinion that it is expedient to have recourse to tracheotomy, and temporary use of the tube, in those cases of simple ulcer of the larynx which threaten to resist ordinary remedial means, and which, by loss of substance, endanger the function of the part ; operating before life has been threatened by intercurrent œdema ; when there is soreness on pressure of the thyroid cartilage ; when pain is felt acutely, on the box of the larynx being rubbed laterally across the spine ; when there is a sensation of rawness and soreness in the part, complained of by the patient ; when there is decided and peculiar fœtor in the breath, with pain and difficulty in swallowing, cough, and purulent sputa—occasionally streaked with blood ; and when these symptoms persist unsubdued. By the operation, the diseased part is put at rest ; counter-irritation and alterative treatment will have a much more powerful and salutary influence ; and besides, an additional opportunity is afforded of applying remedial means directly to the ulcerated parts. From the tracheal wound, the nitrate of silver may be applied freely to the diseased surface, more readily and accurately than through the glottis. And thus, healing may be obtained at an earlier period than otherwise could have been possible ; the part recovers without loss of substance ; and, after a time, the tube may be finally withdrawn, leaving the cure complete. When, however, tracheotomy has been performed at an advanced period

of the case, on account of emergency caused by œdema, the tube's continuance is very uncertain; a falling in of the box of the larynx is too probable, as the result of cicatrization; and, in consequence, permanency of the artificial opening may be rendered indispensable.

2. *Tubercular Ulceration* may attack the windpipe; constituting the true *Phthisis Laryngea*. There is first submucous or mucous tubercular formation, which softens, disintegrates, and opens up the membrane in patchy chronic ulceration. The scrofulous cachexy attends; and too frequently, also, *phthisis pulmonalis* is co-existent. Although by no means likely to make a satisfactory impression on such a constitutional malady, still the ordinary treatment is to be patiently employed. Tracheotomy is certainly not advisable, as a means towards cicatrization and cure; but it may be had recourse to as a mere palliative—a means of protracting existence—when, by the occurrence of œdema, life is threatened by suffocation.

3. *A diseased state of the cartilage* is not unfrequent, in broken down syphilitic habits; associated with chronic abscess and ulceration. In advanced age, the cartilages naturally become ossified, and may necrose. But this which we now allude to is a different affection; bearing the same analogy to senile degeneration of cartilage, as atheromatous change in the arterial tissue, favourable to aneurism, does to the senile calcareous condition of arteries. The cartilage is thickened, indurated, changed in hue, and partially ossified; portions die; suppuration takes place around; the matter bursts into the windpipe, and is expectorated; a ragged ulcerated aperture remains; the diseased portion of cartilage loosens, protrudes, and, having been wholly detached, is expectorated; the cavity which held it may then contract and close, along with the ulcerated aperture through which it made its escape; or additional suppuration takes place, fresh portions become necrosed, and the disease is both aggravated and protracted. In the most favourable point of view, prognosis is unsatisfactory; for cicatrization cannot take place, without entailing such contraction and change of the canal as must seriously and permanently interfere with respiration. Sometimes a dead portion of ossified cartilage, having been detached, falls downwards; and becoming impacted in a bronchial ramification, leads to a fatal issue, either suddenly by asphyxia, or more remotely through pulmonary disease.

Treatment is as in ordinary ulceration of this part, with especial attention to the constitutional vice. And when an emergency, perilling life, does occur, by intercurrent œdema of the larynx, tracheotomy is certainly advisable; not with the hope of thorough cure, but in order to avert immediate danger, and perhaps to accelerate cicatrization. If life continue, the tube must be permanently worn; for, under the most favourable circumstances, it is not to be expected, in this affection, that normal calibre and function can be regained.

Tracheal Fistula is apt to result from the preceding affection. The abscess connected with the necrosed portion of cartilage may discharge itself externally, as well as into the windpipe, and a fistulous aperture is not unlikely to remain. This may be brought to heal, by the occasional use, at long intervals, of heated wire. But let no attempt at closure be made, until we are certain that the necrosed portion has been

fairly extruded, and that no fresh sequestrum is in progress there; otherwise by confining the matter, and so causing swelling and obstruction, serious consequences to respiration may ensue.

Warts of the Larynx.

Warty excrescences have sometimes been found growing from the lining membrane of the larynx, at its upper part; and solid enlargements of structure, pendulous, pyriform, and of the nature of polypus, have also occurred, though still more rarely. They necessarily impede respiration; and, by leading to an inflammatory accession, with its attendant oedema, they may bring life into sudden and imminent jeopardy. The voice is hoarse, and ultimately lost; a hard cough, like that of croup, is troublesome; and during deglutition and expectoration, the sensation

is felt of a foreign body in the larynx; but the most characteristic evidences are the expulsion of small portions of the tumour by coughing, and the seeing and feeling its upper part by careful and deep exploration of the fauces. By means of the laryngoscope these warty growths can be easily recognised, and even treated. The old plan for their removal, consisted in seizing them with forceps, introduced by the mouth, when they could be recognised by the finger and easily reached. When this was impossible, laryngotomy has been performed to effect their removal. But the laryngoscope enables the practitioner, versed in its use, to see, secure, and remove the pendulous growth, by means of a Wilde's snare, the parts being rendered partially insensible by means of chloroform, or by the preliminary administration of the bromide of ammonium. When an emergency by dyspnoea occurs, laryngotomy or tracheotomy is plainly required. Through the wound—made

more free than usual—the growth is removed, by evulsion or knife. And for some days, at least, the use of the tracheotomy tube will be expedient, lest inflammatory swelling occur at the injured part.*

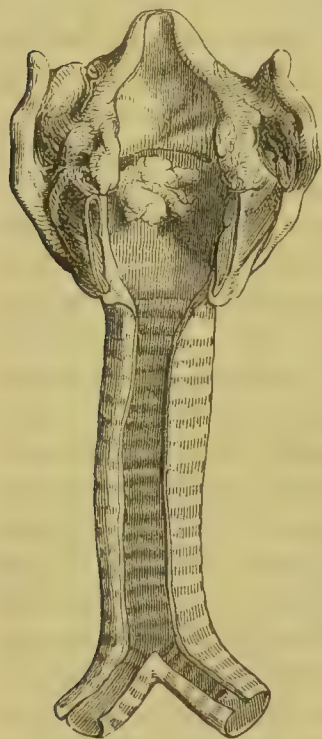


Fig. 299.

Stricture of the Windpipe.

Contraction of this tube is liable to occur, at various points, and from various causes; by contraction of the wound after cut throat; by contraction after cicatrization of ulcers; by change of structure following on chronic laryngitis, independent of ulceration; by necrosis and discharge of portions of cartilage, and consequent narrowing of the passage after closure of the ulcerated cavities. It is doubtful whether our art may be

* *Vide* Monthly Journal, Dec. 1846, p. 458.

able to restore the normal calibre and function in such cases, by dilatation, as in similar affections of other mucous canals. The experiment has been made;* but the present voice of experience is as yet scarcely in favour of the measure—except in the case of contraction after wound. Life may often be protracted, however, and suffering alleviated, by continued use of the tracheotomy tube, of full size; and by unremitting attention to keep both tube and trachea free from accumulation of viscid mucus. The latter indication may become of easy fulfilment, in consequence of the tracheal and bronchial membrane losing much of its sensibility—becoming almost cutaneous in this respect, and not resenting a tolerably free use of probe, feather, sponge, or other means employed for clearing the passage.

Formation of Matter near the Larynx.

Diffuse infiltration of purulent matter may take place, deeply, in the neck; and the consequent swelling and tension may seriously impede respiration, by encroaching on the canal of the windpipe. The proper remedy is free incision of the infiltrated part, whereby both cause and effect are at once removed. Should this fail, or should the symptoms prove obscure so as not to warrant or even indicate incision, tracheotomy is certainly advisable.

Circumscribed abscess may form in the vicinity of the larynx. And

* Liston, *Elements*, p. 453.

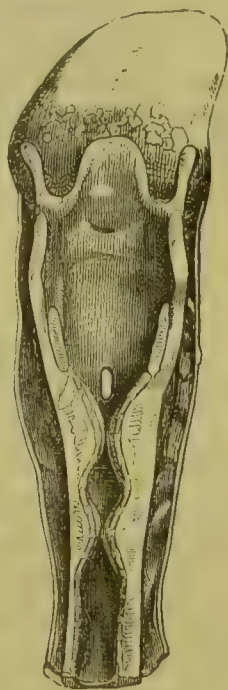


Fig. 300.

Fig. 300. Double stricture of the trachea; the canal decidedly dilated on the lower aspect of the second contraction. "The patient had worn a small silver tube in an opening in his windpipe for many years. It was originally introduced on account of long-continued disease of the larynx, with dreadful suffering and constant sense of impending suffocation. He could not be made to dispense with the tube entirely, as he felt immediately on the wound closing a threatening of return of his painful and dangerous symptoms. A small one was substituted for that at first used. He led a very irregular life, used a vast quantity of opium, and no small amount of spirituous liquors. He used to be out in the open air occasionally all night, and suffered repeatedly under attacks of bronchitis. He was under treatment again and again in the hospital, on account of rheumatic affection and deranged digestive organs. He used occasionally to present himself, complaining of difficult breathing, and stating that his silver tube was too short. He could articulate tolerably well when he stopped with his finger the orifice of the silver tube; at all times a part of the respired air passing through the natural channel. Latterly, he used to suffer from threatening of suffocation, and he used to relieve himself of the cause of this, viz., the inspissated and ropy mucus which got entangled in the trachea, then not suspected to be in a diseased state, by pushing through the opening in his neck, and into the bronchi, long turkey's feathers; of these he carried a good store, and some are now in my possession. This feat he performed without causing the slightest excitement or coughing. Ultimately, and about twelve years after the operation had been performed, he died, principally from diseased viscera."—LISTON. *Vide Elements of Surgery*, p. 454.

the rules of practice are the same ; an early evacuating incision, if possible ; otherwise, tracheotomy.

The passing of tubes into the windpipe, by the nose or mouth, has been proposed as a means of superseding bronchotomy. But modern experience limits their use to cases of suspended animation, unconnected with laryngeal or tracheal disease ; and even then, their superiority may come to be a matter of question and doubt.

Bronchotomy.

Bronchotomy, including, as that term is intended to do, both *laryngotomy* and *tracheotomy*, is required—

1st, For the removal of foreign bodies from the larynx, trachea, or bronchi.

2d, To permit free ingress of air to the lungs in cases of laryngeal obstruction, where death by asphyxia is threatened.

The causes which produce such obstruction are, as we have seen, very various ; the most common are due to inflammatory or ulcerative change in the larynx itself ; but spasm of the larynx, direct or reflex, and mechanical causes—such as exist in wounds or injuries of the larynx or trachea, or when pressure on the larynx or upper part of the trachea is produced by inflammatory or other swellings—also occasionally require us to have recourse to this operation.

In the great majority of cases, tracheotomy is preferable to laryngotomy, for obvious reasons. Laryngotomy, in fact, should never be an operation of choice, except where the urgency of the case, or the absence of suitable instruments and assistance, preclude us from performing tracheotomy. The reason is threefold—1st, In all cases of an inflammatory kind, tracheotomy enables us better to get beyond the range of the obstructing cause. 2d, In cases of foreign bodies lodged in the larynx, the high operation of tracheotomy gives equal facility for reaching the foreign body, and effecting its dislodgment. While 3d, by dividing the laryngeal cartilages, or even the crico-thyroid membrane, we risk the infliction of more or less permanent injury to the laryngeal apparatus, and thus increase the probability of determining persistent aphonia.

Laryngotomy.

The performance of this operation having been determined on, the patient is seated on a chair, with the head thrown back and steadied. A longitudinal incision is made over the box of the larynx, in the mesial space ; by dissection, the crico-thyroid membrane is exposed ; and through this an opening is then made by the knife—as free as the cartilaginous boundaries of the space will allow—or more so if required, by dividing the cricoid cartilage. A penknife plunged into the crico-thyroid membrane, the wound being extended downwards through the cricoid cartilage will enable us in an emergency to effect this operation quite satisfactorily and, as we have said, it is only in such circumstances that it can ever be required. A large ascites-trocar and canula, if at hand, may be employed for the same purpose ; and the canula, being retained, will act as a tube

When no tube or canula is available, a thin piece of wood introduced longitudinally, and then turned on its axis—or the common dissecting forceps lodged, and then turned on themselves—will suffice to maintain patency of the incision and free access of air to the larynx. There will seldom be any trouble by hemorrhage.

Tracheotomy.

This operation may be performed anywhere between the lower margin of the cricoid cartilage and the notch of the sternum. The existence, however, of the isthmus of the thyroid gland, dividing the space into two parts, requires the consideration of a high and a low operation of tracheotomy; the high, between the cricoid cartilage and the upper margin of the isthmus of the thyroid gland; the low, between the isthmus of the thyroid gland and the upper margin of the sternum. The high operation is appropriate to the cases of injury of the larynx, of mere spasm of the glottis, of foreign bodies lodged in the larynx, and to all the inflammatory affections unattended by croupous formation. The lower is better suited to foreign bodies moving up and down the canal, or impacted in the lower part of the trachea or bronchi; and for croup, where our object is to get beyond the part most liable to the membranous formation. In either operation, the patient having been placed as for laryngotomy, an incision is made in the mesial line of the lower part of the neck, from an inch and a half to two inches in length; in the upper operation, its extremity terminating a little above the cricoid cartilage. Skin, fat, and fascia having been divided, carefully avoiding the bulging veins lest they should be wounded, the commissure of the sterno-hyoid muscles is exposed; and this is separated by the handle of the knife. The tracheal rings are made bare by a little further dissection; detachment of the areolar investment being effected by either the point or handle of the knife, according to circumstances, and the thyroid gland drawn downwards by means of a blunt hook if necessary, care, at all events, being taken to avoid wounding its texture.

In the lower operation the incision commences about two inches above the jugular notch of the sternum, and is carried down to its upper margin. The superficial dissection is the same; only the anterior jugular veins, being larger, and their branches more numerous and more in the way, require even greater care to keep them free of injury; and after dividing the fascia, the sterno-mastoid muscles bulging forwards increase the depth of the wound. After opening the deep fascia and separating the sterno-thyroid muscles, the trachea, instead of lying close beneath, and easily recognised by its continuity with the cricoid cartilage, lies deeply, and is not so readily seen or felt. Here, besides, are the superior thyroid veins, possibly also the *thyroidea ima* artery; and by partial or complete abnormality in the distribution of the larger vessels of the neck, they too may be in risk, unless the operator is careful to see or feel everything before he cuts it. The isthmus of the thyroid gland, in females, and the same part with the still larger thymus, render the operation still more difficult in very young and tender children, as in these the soft tracheal structures are sometimes easily over-

looked. The windpipe should on no account be opened in tracheotomy, until the surface has been thoroughly cleared, and its rings recognized either by touch or sight. The blood is then carefully sponged away ; the wound is held open by an assistant with blunt hooks ; and the patient, if adult and conscious, is directed to swallow saliva. While the windpipe is rendered tense and elevated in the act of deglutition, the knife is made to penetrate at the lower part of the wound, with its back to the sternum ; and, by a sawing movement of the instrument upwards, the necessary extent of tracheal wound is completed ; in the low operation, the isthmus of the thyroid gland being pushed upwards out of harm's way, by the finger, if need be. If operation have been undertaken on account of the lodgment of a foreign body, no tube is necessary. The wound having been made, the foreign substance, if loose, will be expelled at once ; if not, it is to be sought for by probe and forceps, as formerly stated. In the case of disease, it is our object to establish a constant and sufficient aperture for respiration, at the site of the wound ; accordingly, a curved silver canula is introduced ; and this is retained by tapes passing from a ring on each side of the canula, to be secured behind the neck. The canula is of sufficient size to atone, completely, for the temporarily occluded rima ; varying, consequently, according to age ; and, generally, of not much less diameter than the trachea which receives it. Yet it should not be so large as to press harshly on the lining membrane of the passage, lest ulceration be induced. The wound should be of size sufficient to receive the canula, without force, and yet not too freely ; the cut margins should be compressed by the canula, internal escape of blood being so prevented ; and this object is further contributed to by the conical form of the instrument. To facilitate introduction, the tube may be provided with a plug, the bulbous end projecting—as in the vaginal speculum ; or the canula may be sloped away diagonally, so as to make it unequally truncated, and thus more easy of entrance. By some, the blunt hooks which have hitherto been employed to keep the edges of the wound apart, are introduced into the tracheal aperture, and there used to hook the edges of the aperture to either side, thus affording a patulous opening for the tube. By others, a broad director is employed for the purpose of guiding the tube's introduction.

The circumstance of the canula's introduction being itself an efficient means of checking the venous bleeding, when copious, by the free respiration relieving the engorgement of the right side of the heart, makes it prudent to proceed to open the windpipe without waiting for entire cessation of bleeding ; no valuable time should therefore be lost in trying to stem venous hemorrhage ; main jets of arterial blood, if any, having been secured, the tracheal wound is at once made, and the tube as speedily introduced. At first the presence of the foreign body, and of the small quantity of blood which has necessarily entered along with it, is much resented ; a violent fit of spasmodic cough, threatening suffocation, ensues ; but the blood having been thrown back, through the tube, this fit of irritation passes off, and comparatively calm respiration is speedily established through the artificial opening. When the tube has been satisfactorily lodged, and the access of violent cough attended by expectoration of blood, mixed with mucus, has ceased, the patient is laid o

his side, so as to render the wound dependent, and favourable to the outward escape of fluids. For many hours—but more especially during the first few—the patient must be carefully watched, lest the tube become obstructed by mucus; and this is from time to time to be cleared away, by a probe armed with lint or sponge, or by a feather; or better still, the double canula should be used from the first, admitting of one portion remaining in the wound, while the other is withdrawn and cleaned occasionally. Such attention is particularly necessary, as formerly stated, if the patient have fallen asleep after the operation. These precautions are also very essential in the case of young children, and when the operation has been performed on account of croup; the thick glutinous

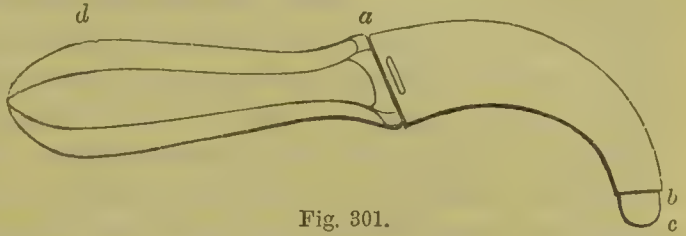


Fig. 301.

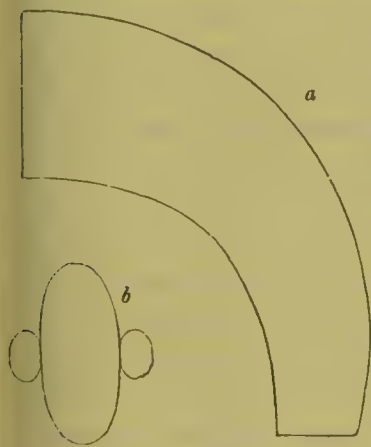


Fig. 302.

mucus, which continues for days to be expectorated, requiring especial care in effecting its complete removal. When expectoration is attempted, it is necessary to diminish the aperture of the ordinary tube very considerably, by temporary application of the finger; so that the expired air may be expelled forcibly. At first, this narrowing is made by the surgeon; but soon the patient becomes an adept in the simple manipulation. Should he be too weak to expectorate, it is well to attempt extraction of the mucus by suction; by the adaptation of a syringe and

flexible catheter, or by the mouth of the surgeon or of an assistant, when the case is urgent.

As already seen, in some cases the tube may be withdrawn, and the wound permanently closed, after a few days or weeks; in other cases, normal respiration can never be restored, and the tube must be worn during the remainder of life. And in these latter, it is truly surprising how little inconvenience is sustained; respiration becomes easy and silent, and even the voice may be regained, so far as to admit of the patient fulfilling the ordinary duties and customs of society.

In cases of old standing, in which the tube is permanently retained, the double canula is specially useful; one portion being removed from time to time, for the purpose of being cleaned, while the other remains, keeping the canal constantly free. To the orifice, too, it may be well to attach a valve, which opening to the full in inspiration leaves the whole space free, but shutting in expiration forms a smaller aperture suitable for expectoration.

The prominent danger of the operation is by hemorrhage, chiefly

Fig. 301. Canula, as recommended by Dr. Gairdner. From *a* to *b* the canula; *c*, the end of the plug, projected; *d*, the handle of the plug. The plug is of course withdrawn so soon as the canula has entered the windpipe.

Fig. 302. Ordinary canula; *a*, in profile; *b*, transverse section of orifice.

venous. During the incisions this is to be guarded against by caution in the placing and making of them ; more especially avoiding the anterior, jugular, and thyroid veins, which are sure to be found large and bulging in the lower and front part of the neck ; and if any stray vessel be encountered, it should be held carefully out of the way by an assistant. Arterial branches, which spring, are to be secured by ligature ; venous orifices, which bleed so as to interfere with the progress of the operation, might be similarly treated ; in most cases, however, it is unnecessary to delay for any such purpose, temporary pressure being applied.

It has been often proposed, with a view to render the operation both more simple and safe, to perforate the trachea by means of a trocar and canula ; discarding the knife ; and ingenious instruments for this purpose have been invented by Dr. Marshall Hall, and others—such as a grooved sharp hook, for guiding the knife in its plunge, and forceps terminating in a curved double lancet point, with cutting edge behind. Most practical surgeons, however, prefer, with reason, the method by incision.

In all cases, it is obviously of much importance to keep the patient in an equable and genial temperature, to cover the wound with some cloth of loose texture, and to take every other means which may suggest itself, as likely to ward off inflammatory accession by the stimulus of cold air directly applied to the membrane—as in the case of cut throat.

In the child, operation may be rendered extremely difficult ; by the restlessness of the patient, the crying and struggling which engorge the veins, the small size of the trachea, the limited space of the neck, the number of veins likely to be encountered, and the intolerance of loss of blood on the part of the system. The dissection must be conducted with unusual caution ; and it is well, after exposure of the trachea, to fix it by means of a sharp hook, so as at once to facilitate and render more safe the performance of the tracheal wound. So soon as this has been effected, the child should be instantly turned upon its face, so as to prevent, as far as possible, escape of blood into the trachea. On cessation of the hemorrhage, the ordinary position may be resumed, should the circumstances of the case render this expedient.

In most cases, anæsthesia will be considered inexpedient, except during exploration by forceps after the operation has been performed, on account of the lodgment of a foreign body.

Disease of the Cervical Vertebæ.

The chain of cervical vertebæ, like other bones, with their articulating surfaces, is liable to diseases of various kinds :—1. The bodies of the vertebæ may be interstitially absorbed, from ricketty, simple inflammatory, or rheumatic change in their osseous tissue. Then a greater or less degree of curvature is likely to ensue ; the head usually bending forwards, with deviation to one or other side ; and in the latter forms there is not unfrequently some thickening of the soft parts exteriorly, in consequence of a concurrent chronic inflammatory process slowly advancing there. 2. Or the bodies of the vertebæ, first undergoing change in structure by a softening of the osseous tissue, are affected by sup-

purative results. At first there are thickening, hardness, and tenderness on pressure; indicating the ostitic and periostitic stage. Afterwards, when matter forms, the bones are found rarified by transformation of the osseous tissue and the development of caries; while portions may be detached in the form of sequestra. There are pain—most severe at night, and aggravated on pressure or motion—swelling, and the other usual signs of an advancing process of osseous disorganization. More or less deformity, by angular curvature, necessarily precedes, accompanies, and succeeds; and is due to change in the form of the bones. As can be readily understood, deglutition is early and much interfered with; and by encroachment on, and involvement of, the spinal cord and the roots of the cervical nerves, serious results are likely to occur, as regards respiration. The functions of the superior extremities, too, may be perilled, by affection of the brachial plexus. The disease is generally connected, in the patient's narrative, with external injury; and the persons most likely to be affected are the young and strumous. 3. Or disease may originate in the articulating textures; ultimately inducing similarly destructive results. When the inflammatory disease attacks the atlas, axis, and the occipital condyles, the symptoms are even better marked than when it affects the bones lower down. The violence of the pain renders all movements of the head impossible, and even eating or speaking are attended with severe darting pains through the parts. On account of the great natural mobility of that portion of the neck, the patient finds it necessary to afford his head additional external support; and this he does with his hands. His expression becomes anxious, and expressive of great suffering. As the disease advances, and suppuration ensues, the pressure caused by the pus upon the lower part of the medulla oblongata gives rise to violent peripheral pains, sickness, and vomiting, with loss of voice and power of deglutition. His inspiration becomes laboured, general paralysis is established, or convulsions ensue and terminate his miserable existence. In other cases, destruction of the transverse ligament of the atlas and its superior and inferior appendages admits of the head and atlas falling forwards, so that the odontoid process of the axis compresses the medulla oblongata, and produces sudden death. Sometimes the patient dies simply from exhaustion. In rare instances the abscess opens into the upper part of the pharynx, portions of bone are discharged, and recovery may take place. It is rare, however, for the abscess to open before the patient's death.

The obvious treatment of such cases is to endeavour to arrest the progress of the disease by keeping the part at rest. All suddenness of motion in the neck is especially to be avoided; indeed, as we have seen in most cases, the patient has an instinctive dread of such risk, and carefully guards against it; turning the head slowly, and with the chin supported on the hand. In the case of disease affecting the atlas and dens, such precaution is particularly necessary; lest by sudden rupture of the ligamentous apparatus, displacement should occur, causing fatal compression of the medulla. The indication is effected by rest in the recumbent posture, with the head, neck, and shoulders kept steady by means of a suitable splint. This is best made of hard leather, moulded, when softened in hot water, to the form of the occiput, neck, and dorsal

vertebrae, and then allowed to harden in contact with the parts. It should be well padded with chamois leather, and having been attached below to a thoracic belt, is fastened in front by lateral neck straps, and secured above by a frontal strap. The old plan of permitting the patient to move about with an elaborate apparatus, by which it was attempted to relieve the affected bones from the weight of the head, as much as possible, by mechanical means, is not found to answer. This apparatus consisted of a firm iron-rod, fixed in a circular girth on the trunk, passing upwards, excurvating forwards to receive the posterior part of the head, and terminating over the forehead by a bandage or strap attached to the extremity of the rod and passed under the chin. In all cases local and constitutional treatment is required. Of the former, powerful counter-irritation, in the form of the actual cautery, applied laterally so as to avoid the splint, will be found far more serviceable than any other. Leeching is rarely admissible, except the case is seen at the very outset, and is attended, in an otherwise healthy-looking patient, with acute suffering. The constitutional treatment should consist of cod-liver oil and tonics; and in some cases, when the disease is traceable to syphilis, congenital or acquired, iodide of potassium will prove of service. Should matter form in considerable quantity, and seek to approach the surface, at the lateral or posterior part of the neck, a free and early incision is to be made, for evacuation. In any case, the only hope of cure is by anchylosis.

CHAPTER XLVI.

AFFECTIONS OF THE ARTERIES OF THE NECK AND SUPERIOR EXTREMITY.

Deligation of the Carotid.

THE *common carotid artery* may require deligation on account of aneurism, hemorrhage by ulcer or wound, or erectile tumour in the orbit. Carotid aneurism is more common in females than in males, and is usually situated at the upper part of the vessel, near the angle of the jaw ; forming a tumour there of the ordinary characters, which, should it become diffuse, might seriously interfere with respiration. It possesses a peculiarity of being ill surrounded by repressing tissues ; and, growing chiefly towards the pharynx, may imperfectly consolidate after operation. Sometimes—but fortunately comparatively seldom—the disease affects the origin of the artery ; and then its interference with respiration is more early and serious. From sudden increase of the tumour—by diffusion or otherwise—immediate performance of tracheotomy may be demanded to save from urgent threatening of asphyxia. In traumatic aneurism, the aperture in the vessel may be either high or low in the neck ; in the former situation admitting either of the Hunterian operation, or of that by laying open the sac, as circumstances may render expedient. In the latter case, the arterial aperture is compressed with the finger against the transverse processes of the vertebræ, and the trunk tied above and below the wound.*

The artery may be secured at any part of its course ; but, when we have our option, the operation has usually been performed at one of two points ; above or below where it is crossed by the anterior belly of the omo-hyoid muscle. The former situation is the more easy of access, and is to be preferred when circumstances are favourable ; but in cases of aneurism, the tumour will generally be found to have encroached too far on the upper triangular space.

The superior operation is performed thus :—The patient having been placed recumbent, with the head thrown back and turned slightly to the opposite side, an incision, from three to four inches in length, is made through the integuments, platysma myoides, and fascia of the sterno-mastoid, extending in the direction of and over the inner border of that muscle, from the level of the upper margin of the thyroid cartilage, to a point below the level of the cricoid cartilage. The inner margin of the sterno-mastoid is drawn outwards, and the deep fascia of this muscle

* See SYME'S Observations in Clinical Surgery.

carefully divided, with the use of forceps, at the angle of the crossing by the omo-hyoid; the cross veins, which so often occur in this situation, are avoided; the margins of the wound are held asunder by means of bent copper spatulæ; and it may be useful to relax the parts somewhat, by changing the position of the head. The descendens noni is pushed aside; the common sheath of the vessels, having been pinched up by forceps, is opened to its inner side, over the arterial compartment, to the requisite extent; and cautious isolation of the artery is proceeded with, so as to afford clear space for passage of the aneurism needle—and no more. The needle is passed from the outer side; the jugular vein, which on the left frequently overlaps the vessel, being if necessary repressed; and thus risk is avoided of injuring the vein, or including the par vagum. Before securing the knot, especial care should be taken to ascertain that nothing but the arterial coats is included.

The inferior operation is more generally suitable in the case of aneurism, as already explained. The patient having been placed as before, an incision of about three inches in length, parallel to the inner border of the sterno-mastoid, but over the inner part of the muscle, is begun a little above the level of the cricoid cartilage. The muscle, having been exposed, is turned outwards; while, after opening the fascia below the margin of the omo-hyoid, the sterno-thyroid and sterno-hyoid muscles are, along with the thyroid gland, drawn inwards, and the sheath, which here is much looser and less marked than above, having been opened, the operation is completed as before. The descendens noni, in the former case in front of the sheath, is here found inclining to the tracheal side of the artery. On the left side, the jugular vein is very apt to prove troublesome by overlapping; on the right side, it recedes from the carotid, to meet the subclavian vein.

After the operation, congestion of the lungs, with its baneful consequences, must be guarded against by suitable means for its prevention and arrest. When both carotid arteries have been tied within a short period of each other, cerebral softening has been known to ensue; and this has also occurred as a distant result of the operation on one of these vessels.

In the case of aneurism at the angle of the jaw, external pressure may be advantageously made on the tumour, so as to atone for the deficiency of repressive textures, formerly alluded to. In all cases it is well to keep the neck bent, so as to relax the artery.

The vessel at its inferior part has been secured by a transverse wound; cutting the sternal portion of the sterno-mastoid across, and then opening the sheath in the ordinary way.* Others, following the suggestion of Sedillot, recommend that the root of the vessel should be reached through an incision corresponding to the interval between the sternal and clavicular fibres of the sterno-mastoid; while some, with more reason, advise that two incisions should be employed, one parallel to the fibres of the muscle, the other joining the extremity of the first transversely, and dividing the attachment of the sterno-mastoid with the fibres of the sterno-thyroid more or less extensively.

In the case of aneurism at the root of the common carotid, deliga-

* HARGRAVE, Dublin Quarterly Journal, Aug. 1849.

tion of the artery at its upper part has been practised, with anatomically a more reasonable hope of cure. For, as formerly stated, the common carotid is favourably adapted for Brasdor's operation, should it ever again be deemed right to undertake its performance.

Deligation of the External Carotid, and its branches, is required only in the case of hemorrhage; and chiefly on account of wounds. No definite rules need be given as to the operative procedure; this must be guided by the general principles formerly inculcated, and modified by the particular circumstances of the case—the rule being to tie the bleeding vessel at, and on both the cardiac and distal aspect of the bleeding point. The *lingual* arteries have been tied—in one case by Mr. Liston, for aneurism by anastomosis of the tongue; and on other occasions for hemorrhage after wounds of that organ. The results of such a practice, however, have not been of a kind to encourage its imitation. The *superior thyroids* have also been tied, in the hope of arresting the development of thyroïdal enlargements, with no satisfactory result. The *facial* requires double ligature when divided in excision of the lower jaw. The *temporal* used frequently to be the subject of operation on account of secondary hemorrhage, or traumatic aneurism, when arteriotomy was performed in the main trunk, and not in its anterior branch.

Deligation of the Arteria Anonyma is an operation now considered hopeless; and, in all probability, will never be repeated by any judicious surgeon; circumstances seeming to be insuperably hostile to satisfactory occlusion of the artery at the deligated point. In Gräfe's and Lizars' cases, fatal secondary hemorrhage supervened at the end of two months after the operation. The ligature of the root of the carotid and first stage of the subclavian, which has been practised as a substitute, has been found equally disastrous in result.

Deligation of the Subclavian.

This artery requires ligature, on account of axillary aneurism. Hemorrhage by wound or ulcer is likely to call for the operation but rarely. Although in bleeding from the axillary artery, or from the deeper parts of the axilla, ligature of the subclavian, with the application of a graduated compress in the cavity of the axilla, has been followed by satisfactory results, the free anastomosis between the branches of the first stage of the subclavian and the second stage of the axillary renders such a plan of treatment unsound in principle. The facility of the ligature of the subclavian, and the avoidance of an extensive division of the anterior wall of the axilla, which deligation of the vessel at the bleeding point would of course require, has probably been the reason why the subclavian ligature has been preferentially resorted to in such cases.

The subclavian artery is conveniently divided for surgical consideration into three portions; *internal*, from its origin to the inner border of the scaleni; *middle*, where overlaid by the *anterior scalenus*; *external*, between the outer border of this muscle and the lower margin of the first rib or *costo-coracoid aponeurosis*. On the right side, it is possible to secure the artery at any of these parts of its course; on the left, the two last are equally accessible; but the internal third—being not only

more deeply seated, but also in close relation with the apex of the left lung and pleura, the subclavian, internal jugular, and innominate veins, the thoracic duct and vagus nerve (some of which can scarcely fail to sustain serious injury in the attempt)—may be excluded from the category of vessels admitting of deligation. On either side, the ligature of the *middle*, as well as of the *internal* third is not desirable, on account of the propinquity of large branches at the deligated point. The *external* third, therefore, may practically be alone considered as eligible for operation. But if, in performing the ordinary operation on this part of the vessel, the coats appear unsound, we are fully warranted in cautiously dividing the scalenus muscle, of course taking care of the phrenic nerve which lies close to its internal margin, and seeking inwards for a more healthy portion of the vessel.

Deligation of the external third is best accomplished by the method originally employed by Mr. Ramsden in 1808, with, however, a fatal result, and first performed with a successful issue by Dr. Post of New York in 1817. The patient having been placed recumbent, on rather a high table, and the shoulder, if elevated by an axillary aneurism, having been depressed as much as possible, an incision is made above and parallel to the clavicle, through the skin and platysma myoides; extending from over the clavicular origin of the sterno-mastoid to the anterior border of the trapezius—or even a little further in both directions, should the clavicular origin of these muscles occupy the greater extent of the base of the posterior triangle. Before making this incision, it is well, by pressure behind the margin of the sterno-mastoid, to ascertain the site of the external jugular vein so as to avoid wounding it. This may be even more satisfactorily insured by drawing the skin downwards over the clavicle and cutting upon the bone, so that, on resilience, the wound may correspond with the course of the vessel. A second incision is made to fall into the anterior extremity of the first, in the line of the posterior border of the sterno-mastoid; and the flap thus indicated is slightly reflected. This second incision may, however, be dispensed with, except where the neck is short, the veins much in the way, the clavicle much pushed upward, or the oozing into the wound a source of interruption. The cervical fascia is divided; the external jugular vein is turned aside, if it bulges inconveniently; the fat, glands, and areolar tissue are dissected through to the full extent of the external wound—when the posterior belly of the omo-hyoid will be seen shining through its sheath of the deep fascia; and then we know that in the triangular space between that muscle, the clavicle, and the sterno-mastoid, is contained the object of our search. The deep fascia having been cut through, the outer edge of the scalenus muscle is sought for; and now the field of search is further limited; for the artery will be found by tracing the border of the muscle downwards, by means of the finger, to the tubercle of the first rib, behind which, and between it and the cords of the brachial plexus which are usually seen exposed immediately above and behind this point, the artery is felt pulsating. The site of the vessel having been reached, it is cautiously isolated to the requisite extent; and the needle is passed from the clavicular aspect—not that the subclavian vein runs any risk, for it lies in front of the scalenus, and below the level of

the upper border of the clavicle, but because in most instances the needle can be most easily carried round the vessel in this direction. Before securing the noose, pressure should be made by the finger on the included texture, so as to make sure that it is the artery, and not one of the cords of the brachial plexus which has been taken up. In making the dissection, near the clavicle, care must be taken to cut, not behind that bone, as if the axilla were the direction, but perpendicularly backwards towards the vertebræ. Care must also be taken to avoid cutting the transversalis humeri or transversalis colli arteries and veins. The arteries, if cut, prove troublesome by hemorrhage; and, besides, these vessels are important as a means of collateral circulation after obstruction of the main trunk. In the great depth which has sometimes to be encountered in this situation, assistance may be derived from one or other of the auxiliary needles which have been invented; but it has so happened, hitherto, that the ordinary instrument, in skilful hands, has been found quite sufficient. In all cases, however, difficulty is to be contemplated when the neck is short, the shoulders square instead of sloping, the patient a female or fat; and in the dissection allowance must always be made for the increased depth of the vessel's site, resulting from displacement of the shoulder upwards by the axillary tumour.

To secure the *middle third*, a plan of incision similar to that just described will suffice. The fibres of the scalenus are cautiously cut through so as to avoid injury of the phrenic nerve, which crosses the muscle above, and here lies to the inner margin; and the ligature is applied with equal caution, to avoid injury to the arterial branches of this part of the vessel. Should these be seen coming off from the vessel, however, their deligation would of course prevent the current of blood continuing to flow past the point of ligature, and thus serve to diminish the risk of secondary hemorrhage.

To expose the *internal third*, on the right side, let an incision be made a little above the clavicle, more anteriorly than in the former operations; and into this a second incision is made to fall, along the inner border of the sterno-mastoid. The sternal attachment of this muscle is then divided, and turned aside, outwards. The sterno-hyoid and sterno-thyroid muscles, having been exposed, are divided cautiously from their outer border, and displaced forwards. The lower part of the carotid may then come into view; this is traced downwards until the subclavian is reached; and this vessel is to be secured as near as possible to the origin of the vertebral, so as to afford space enough between the ligature and the origin of the carotid. The textures to be avoided are the par vagum, and its recurrent branch, the cardiac branches of the sympathetic, the pleura, and the vein. The needle is passed from below upwards, to avoid wounding the pleura and right vena innominata. The operation is one of great difficulty, and has never been followed by a successful issue.

The varieties of distribution to which the arteries of the neck are liable, bear an important relation to the operations just described, and should be remembered and calculated upon by the surgeon.*

* *Vide* QUAIN on the Arteries, with special reference to this subject. For the statistics of ligature of the subclavian, see NORRIS, American Journal of Med. Science, July 1845.

Deligation of the Axillary

Was first proposed by Pelletan in 1786, who, as well as Keate in 1800, made an abortive effort to carry his plan into execution. The operation was first performed by Chamberlayne in 1815. Modern surgeons have almost agreed, that this vessel should not be made the subject of operation, unless in the case of wound of the artery itself, or of traumatic aneurism, when the general principles of surgery are to be fulfilled by cutting down upon the wounded point, and placing a ligature above and below the aperture. Mr. Syme has, however, recently, with complete success, laid open spontaneous aneurismal swellings occupying this situation, and tied the axillary artery above and below the points of communication with the sac. To effect this safely, compression of the subclavian on the first rib was made by the finger of an assistant, through an incision which divided the fascia of the neck, and thus prevented any movement on the part of the patient from interfering with the efficiency of the compression. Again, in the case of aneurism high in the arm, encroaching so far upwards as to render deligation of the brachial or third stage of the axillary either unadvisable or impracticable, the upper part of the axillary may, no doubt, be secured; but it is an easier, more feasible, and altogether preferable operation, to tie the subclavian in its external third. Aneurism of spontaneous origin below the axillary space is a rare occurrence; and it may very fairly be questioned, whether the operation of laying open the sac in such a case would not be attended with less risk and difficulty than the ligature of either the axillary or subclavian.

Like the subclavian, the axillary artery is surgically divided into three portions; an *upper*, *middle*, and *lower*. And supposing that we have determined on deligation of the axillary, in preference to the subclavian—as, probably, will very seldom be the case—either the lower or the upper third will be selected, seeing that the middle is so covered and mixed up with other textures, as to be almost inaccessible—with safety. In the case of wounds, or in aneurism, where we propose to lay open the sac and tie the vessel within it, no regular directions can be given—further than that, as a preliminary, compression of the subclavian must be arranged so as to completely control the flow through the vessel, and the incision must divide the pectoral muscle or muscles to such an extent as shall afford free access to the vessel.

The ordinary or regular operations are said to be either *superior* or *inferior*, according as the vessel is tied above or below the pectoralis minor muscle.

The *superior* operation is performed thus:—The patient having been placed recumbent, with an assistant ready to compress the subclavian in case of accident, an incision is made, about three inches in length, and of a semilunar form—with its convexity downwards; commencing about an inch from the sternal extremity of the clavicle, and extending towards the coracoid. Or a similar extent of wound may be made, with its convexity upwards, terminating at the anterior margin of the deltoid. In the one case, the clavicular portion of the pectoralis major is at once cut across, in the deep dissection; in the other, the intermuscular space is

dilated. Care must be taken to avoid the cephalic vein and thoracico-acromialis artery. To expose these vessels, however, is scarcely an untoward occurrence, as it may happen to prove a convenient guide to the axillary, of which we are in search. The deep fascia and fat are next carefully cut through ; and it may even be necessary to turn down the upper border of the pectoralis minor ; the funnel-shaped prolongation of the costo-coracoid aponeurosis is then carefully opened, towards its clavicular aspect. The vein will probably be first disclosed, and is to be pressed inwards towards the ribs ; and, the artery having been carefully isolated to the requisite extent, the needle is passed from the thoracic to the acromial aspect. In this operation as many as twelve vessels, branches of the acromio-thoracic trunk, may require ligature.

For the *inferior* operation, the arm is raised from the side, with the hand supinated. In the lower part of the axilla, thus exposed, the head of the humerus is felt occupying the apex of the axilla ; and from this point an incision is made of about two or three inches in length, to the inner side of the coraco-brachialis muscle. Then, on dissecting through fascia and areolar tissue, the median nerve is likely first to be exposed, while the ulnar and internal cutaneous nerves will be seen lying to the inner side, and the axillary vein still internal to them ; the median nerve having been displaced outwards, and the other nerves and veins inwards, the artery will be brought into view. When sufficiently cleared from its areolar connections, the needle is passed from the inner aspect. In the latter part of the operation, it is useful to relax the textures, by bending the forearm.

Deligation of the Brachial.

The *brachial* or *humeral* artery may be secured at any part of its course ; on account of true aneurism, which is a very rare condition ; on account of wound, or traumatic aneurism—not uncommon ; or, according to some authorities, on account of an otherwise uncontrollable hemorrhage from either the hand or the forearm. If such a condition did occur, for obvious anatomical reasons ligature of the third stage of the axillary would be more likely to be followed by an arrest of the bleeding ; fortunately, however, by means of either deligation or graduated compression of the bleeding vessel itself, such a procedure need never be required. In operating, the arm having been steadied on a convenient table or pillow, with the hand supinated, ligature of the brachial is conducted thus :—

In the upper part of the arm, an incision of about two inches in length is made over the vessel—felt pulsating—along the inner border of the coraco-brachialis muscle and median nerve, which can easily be felt rolling under the fingers ; and care is taken to avoid the basilic vein and internal cutaneous nerve, which may lie in the way. The fascia having been divided, the ulnar and internal cutaneous nerves, on the inside—the external cutaneous and median nerves, on the outside—the *venæ comites* close on each side—are avoided ; the arm being bent, for the purpose of relaxing these tissues, if necessary. The vessel having been isolated, the needle is passed from the inner aspect. Sometimes the median nerve lies upon the artery.

At the middle of the arm, the incision is made along the inner border of the biceps muscle, which, overlapping the vessel, may require to be raised slightly. The median nerve is to be expected lying upon the artery; and while this nerve is displaced inwards, and the muscle held outwards, the artery may be separated from its veins and secured. It is right to remember, however, that, in this situation, the *inferior profunda* may be mistaken for the main trunk; and also that, if there be a high division of the humeral, one of the two vessels only may have been tied. Not until the surgeon has been fully satisfied on both of these points, should the operation be completed by approximation of the wound. In the case of high division, the second trunk, if not close to the other, will be found either along the intermuscular septum, in a line with the inner condyle of the humerus; or near its usual situation, but deeply placed, and covered by fibres of the brachialis anticus muscle—conditions which, along with other very common abnormal distributions, should serve as an additional reason for preferring the application of the ligature in cases of wounds, or of false aneurism, to the part of the vessel actually implicated in the injury.

In the lower part of the arm, the median nerve is to be expected on the ulnar side of the artery; but it is seldom that we are called upon to operate in this situation, except for wound of that part of the vessel; which, however, is of rare occurrence, as the artery is so completely protected by the prominence of the belly of the biceps muscle.

At the bend of the arm, false aneurism of the brachial was proverbially common, when blood-letting by venesection was more in vogue. If prevention by methodical pressure have failed in recent cases, the sac is to be cut into, and the vessel secured by ligature above and below the aperture—a tourniquet having been applied above so as to control the circulation. Should any difficulty arise in dissecting the vessel clear, at the point of communication with the sac, a probe or director introduced at the aperture will serve to indicate the outline and direction of the trunk. In tumours of old standing, deligation of the humeral, near its middle, is a simpler, and has in many cases proved an equally effectual procedure. It was this operation which was performed by Anel (1710).

Varicose aneurism, occurring at this site, requires the same treatment as the ordinary form of tumour. For *aneurismal varix*, support by careful bandaging is usually sufficient. Should an operation be deemed necessary, the vessel should be tied without opening the dilated veins.

Deligation of the Arteries of the Forearm.

Deligation here is never necessary except in the case of hemorrhage from wound of the arteries themselves; and then it is sufficient to dilate the existing apertures in the soft parts, and to secure the bleeding point, or points, in the usual way. When ligature of both ulnar and radial has been practised, for secondary bleeding in the palm, hemorrhage has sometimes been reproduced, the communication by means of the interosseous proving sufficient to maintain the bleeding. Then, instead of a threefold and difficult operation, it is infinitely better, if a ligature on the Hunterian principle should ever be employed for such a condition, at

once to perform that which, while much simpler, is equally effectual—deligation of the humeral a little below its middle—or of the third stage of the axillary, if we would avoid all risks of failure. Direct measures at the bleeding point should, however, if properly employed, secure the surgeon against resorting to any such unsurgical proceeding.

The *radial* and *ulnar* arteries are most commonly wounded at the lower part of the forearm ; and should either extremity of the vessel (when cut through), have completely retracted, a knowledge of their anatomical relation should enable the surgeon at once to find them. For the radial, an incision is made between the supinator longus and the flexor carpi radialis ; and from a little below the middle of the forearm, the artery will be found unaccompanied by any nerve. For the ulnar—rendered more superficial by bending back the hand and fingers—the incision is made between the flexor sublimis and the flexor carpi ulnaris. Near the elbow-joint, the latter vessel can be exposed only through a great thickness of muscular tissue, which should not be cut through, but opened up in the direction of the muscular fibres. In the upper part, the radial artery, curving outward through the triangular hollow below the elbow-joint, comes under cover of the supinator longus, and has the pronator teres to its inner side. The prolongation of the radial, between the metacarpal bones of the thumb and fore-finger, may be exposed by an incision on the ulnar aspect of the extensor secundi internodii pollicis, before the vessel dips between the origins of the first interosseous to gain the palm and become continuous with the deep palmar arch. When wounded, it may also be secured in the hollow between the tendon of the supinator longus, beneath which the artery passes, and the extensors of the phalanges of the thumb.

Wounds of the Palmar Arch are apt to be troublesome by bleeding, both primarily and secondarily. In recent wounds, all bleeding points should be secured by ligature, if the wound is free enough to admit of this ; but to avoid the necessity of dilatation being practised, if important parts would require division, pressure by means of a graduated compress may be preferred. For bleeding occurring after the lapse of some days, the application of firm pressure should be had recourse to ; if this fail, then, according to some, deligation of the humeral should be practised. But—as is infinitely to be preferred to such a proceeding—either a hare-lip pin may be made to transfix the wound and compress the vessel ; or a common curved surgical sewing needle, armed with a thread or wire ligature, may be carried deeply beneath the bleeding point, and tied with such a degree of firmness as to prevent the occurrence of further hemorrhage—this being effected on either aspect of the wound, should the single application not suffice to staunch the flow.

CHAPTER XLVII.

AFFECTIONS OF THE BEND OF THE ARM.

Venesection.

THIS operation—at one time, it is to be feared, too frequently performed—is conducted thus. The patient having been placed erect, semi-erect, or recumbent, according as it is wished to withdraw much blood or otherwise, a ligature—a riband, or bandage, or small tourniquet—is placed on



Fig. 303.

the upper part of the arm, and secured with sufficient tightness to arrest the venous return, yet not so tightly as to interfere with the arterial influx—as indicated by the pulse at the wrist. The veins at the bend of the arm, thus made tense and bulging, are scrutinized with a view to selection. A branch which is superficial, and large enough to emit freely, is to be preferred for obvious reasons. The rule usually given is to choose, if possible, the *median cephalic*, a careless manipulator being there less likely to interfere with the brachial artery, the lymphatics of the forearm, or the larger internal cutaneous nerve; so avoiding the risks of aneurism, diffuse inflammatory infiltration, and neuralgic pain. But if, as not unfrequently happens, no vessel except the *median basilic* is found suitable, there the operation should be performed; care being of course taken merely to open, not to transfix the vein.

The arm is placed nearly in a middle posture between pronation and supination; and precautions are taken to secure its being retained in that position unmoved. By the thumb of one hand the vein is steadied by pressure on its distal aspect, to prevent it rolling, and to control the flow of blood until the vessel to receive it has been placed in a convenient position. The lancet for the purpose—neither too spear-pointed, nor too rounded in its blade, should be held between the finger and thumb of the other hand, which is steadied by resting the little and ring fingers upon the inner side of the forearm. The point of the lancet is introduced obliquely across the track of the vessel till the blood appears, by a gentle movement it is carried onwards so as to secure a sufficient aperture being made in the vein, and the point of the instrument is then curved outwards so as

Fig. 303. Illustration of venesection at the bend of the arm.

to make the superficial part of the wound considerably more free than the venous orifice. Then the blood is allowed to flow. If the stream grow sluggish, movement of the fingers, in grasping anything in the hand, will tend to increase its jet, by forcing the contents of the inter-muscular veins into the median, while, at the same time, it accelerates the general venous return. During the whole process, care must be taken to avoid any deviation from the original position of the limb, otherwise the wound in the integument will cease to correspond to the wound in the vein, and the flow of blood will become arrested. The desired effect having been obtained, the thumb is again placed on the distal side of the wound, by which the bleeding is at once arrested; the ligature on the arm is slackened and removed, and the arm is sponged and made clean; a small compress of folded lint is applied over the wound; by a bandage passed in the form of 8, all is secured; and the limb is placed comfortably in a bent posture, supported if need be by a sling. Within forty-eight hours, the bandage may be safely withdrawn; but it is well to avoid use of the arm for some days.

Accidents of Venesection.

1. *Thrombus*.—By this term is understood an accumulation of coagulated blood in the areolar tissue between the vein and integument. This may be caused either by too small an original opening in the skin as compared with that made in the vein, or by movement of the arm causing the two openings not to correspond. When a thrombus forms, it interferes with, and perhaps completely arrests, the flow of blood at the time of the operation; producing an inconvenient swelling afterwards; and not unfrequently inducing troublesome suppuration in and around the wound. The accident is to be avoided, by a suitably free opening being made at once, and by maintainence of one position of the arm throughout the whole proceeding. When thrombus has formed, the coagulum should be carefully squeezed out, an enlargement of the wound being had recourse to, if necessary; and then a suitable compress is accurately applied, so as to keep the tissues in close contact. 2. *Neuralgic pains* may invade the limb; dependent, probably, on puncture of a cutaneous nerve. Such an accident cannot be avoided; when it occurs, the lancet should be introduced into the wound and moved subintegumentally, so as to divide the wounded filament; or an anodyne epithem may be applied. 3. Simple *erysipelas* may follow; and the ordinary treatment is required. 4. *Angeioleucitis* may occur *per se*, or in conjunction with the preceding affection. There is no peculiarity in the treatment. 5. Not unfrequently, *diffuse suppuration* takes place beneath the fascia, which may possibly have been injured by puncture in the operation; more probably, however, the symptoms are due to *phlebitis* or *cellulitis*, arising from the unhealthy condition of the patient, the state of the atmosphere, or the manner in which the operation has been performed. Free incision is imperatively necessary; otherwise serious results, both local and constitutional, are almost certain to ensue. 6. *Aneurismal formations* have been already considered. And in reference to these it is well to remember, that the arterics of the forearm, following an unusual course, may be found quite super-

ficial, and not unlike the ordinary veins. Hence a careful examination of the part should uniformly precede the performance of phlebotomy.*

Affections of the Bursa over the Olecranon.

From habitual pressure—as in the miner—this bursa is liable to chronic enlargement, and the affection is to be treated in the ordinary way ; by abstraction of pressure, and the application of discutients.

Acute bursitis is a frequent consequence of blows on the elbow ; and is usually associated with diffuse suppuration and an erysipelatous affection of the surface. Treatment is by puncture and general antiphlogistics ; and if matter form within the bursa—indicated by the diffuse, tense, brawny swelling which affects the forearm, and the discharge of a thin ichorous or purulent fluid from the wound of the bursa—the aperture should be enlarged by free incision.

* Lately a new variety of the aneurismal lesion has been observed ; the artery projecting its contents *through* the wounded vein, and forming an aneurismal sac by condensation of the areolar tissue exterior to the vein. The deep wound of the vein is closely incorporated with that of the artery ; and the superficial venous aperture is continuous with the arterial sac. Brit. and For. Med. Chir. Rev. April 1850, p. 338.

Sometimes, too, the aneurismal communication is not with the superficial, but with a *deep* vein.—*Ibid.*, p. 349.

CHAPTER XLVIII.

AFFECTIONS OF THE WRIST AND HAND.

Ganglia and Thecal Collections.

GANGLIA frequently form on the wrist and back of the hand. When troublesome as well as unseemly, they may be got rid of by pressure, or by puncture of the cyst, followed by blistering.

Collections of glairy fluid often occur in the thecæ of the flexor tendons in the lower part of the forearm, with or without loose bodies contained; forming a soft bulging swelling, which usually extends into the palm; more or less seriously interfering with the functions as well as with the symmetry of the limb. The double sac thus constituted has a middle contracted channel of communication beneath the annular ligament, and pressure on one or other of the prominences of the sac, by transposing the fluid and the melon-seed-like floating bodies usually contained in it, produces a peculiar churning sensation, which is quite pathognomonic. In these cases, it has latterly been the practice to make a free evacuating incision; afterwards completely dividing the annular ligament of the wrist sub-integumentally, by means of a probe-pointed bistoury introduced through the wound, in the belief both that thus tension during subsequent inflammatory accession will be avoided, and that cicatrization of the whole interior of the sac will be permitted to take place.

According to M. Velpeau, it is both safe and effectual to evacuate the contents by the trocar, and then to inject iodine—in cases where no extraneous bodies exist in the sac.

Paronychia.

No affection is more common than paronychia, or *Whitlow*; more especially among washerwomen, cooks, nurses, field labourers, and others, whose fingers, by the nature of their avocations, are not only kept prone to the assumption of inflammatory disease, but also much exposed to the application of its exciting causes. The whitlow varies both in site and intensity.

1. There is a mild form, limited to the very surface. The finger, at its point, and perhaps in its whole extent, is intensely hot and painful, red, and somewhat swollen; and vesications may be in process of forming. Treatment consists in leeching, fomentation, and general antiphlogistics. Or—as is more frequently practised—the part is rubbed lightly over with nitrate of silver, so as to blacken and desiccate the surface. Reso-

lution is usually effected ; but often not without the formation of one or more vesicles—which sometimes degenerate into superficial ulcers of an irritable character. The disease usually commences at the root of the nail, a hot and painful blush of redness surrounding this ; and hence the term. In consequence of the matrix of the nail, in many cases, being primarily and permanently affected, shedding of the nail need be no unlooked-for event.

2. A somewhat more serious attack is found to pervade the subcutaneous areolar tissue, as well as the skin ; bearing the same analogy to the former affection, as phlegmonous erysipelas does to erythema. It is usually caused by a puncture, laceration, or other wound ; with or without inoculation of irritant matter. The swelling, heat, redness, tension, and pain are greater ; and there is a proneness towards acute suppuration. Treatment must be proportionally active ; as by copious leeching, at the sides of the finger. But, as is far better, by free incision of the affected parts, followed by fomentation and poultice, the disease is checked at once, and the patient saved much pain and delay in the restoration of the parts.

3. The worst form is the most deeply seated ; and, unfortunately, not the least frequent in occurrence. The disease originates in the deep fibrous textures—in the sheath of the tendons, or in the periosteum and bone. Pain is excruciating from the first. For days and nights the patient may enjoy not a moment's sleep, or respite from suffering. Tension and throbbing are early and intense ; so are the swelling, heat, and redness. The back of the hand, and sometimes part of the forearm, are red and greatly engorged with serous accumulation. Matter forms early in the finger ; deep, and confined, and consequently with aggravation. The constitution labours under inflammatory fever, often severe. At the outset, active antiphlogistics, locally and generally, may be employed—copious leeching, fomentation and poultice, purging and antimony—with the hope of averting suppuration. It is rare, however, to have the opportunity of seeing cases in the early stage when only this is of any service. Failing these, there is no relief to suffering, and no means of averting serious destruction of texture, but by early and free incision. It must seem harsh practice to lay a finger open throughout almost its whole extent, on the palmar aspect ; but, soon after the infliction of such a wound, pain will rapidly abate, and in a short time the patient will probably be in a deep unconscious slumber. Free outward suppuration takes place ; the swelling abates ; the bones, joints, and tendons may not be destroyed ; and the finger recovers, tediously it may be, but well. Withhold the incision, and there comes no relief but on spontaneous evacuation of the matter ; and then bones are found carious or necrosed, joints are opened into, tendons are sloughing or sloughed ; the fingers may recover, in some sense, but are stiff and useless ; more frequently, amputation is demanded sooner or later. These results, however, often occur even when the incisions have been very freely and early made. In such cases, the disease has undoubtedly commenced in an inflammatory process affecting these parts—from its extent or severity determining their death. In incising a finger affected with paronychia, the flexor aspect usually requires it most ; and in using the knife the cut should

not be continuous, but should leave intact the folds of flexion of the phalangeal joints.

In both of the more severe forms, extension to the palm, and even up the forearm along the course of the tendons, is by no means unfrequent. The same principles of treatment are to be fulfilled there as in the finger. But in incising, care must be taken to avoid, if possible, wound of the palmar arch. As in most cases when the inflammatory process passes above the annular ligament, it follows the course of the deep flexor tendons, the incision to relieve tension should not only be carried through the fascia of the forearm, but by a little dissection that texture should be exposed, the superficial tendons held aside, and the suppurative collection reached on a deeper level.

Sometimes the severe form of paronychia is limited to the distal joint of the finger. Then exfoliation of the corresponding phalanx is extremely probable. But, fortunately, the whole bone seldom comes away; a portion at the articulation remains; and, from this, regeneration may take place, with but little ultimate deformity.

• *Onychia, or Disease of the Matrix.*

This term denotes a diseased condition of the matrix of the nail; the result of a chronic inflammatory process, inducing a tedious and painful ulceration. The first indications are pain, swelling, and redness, around the root of the nail; and, on pressure being applied, an ichorous discharge oozes from beneath the cuticle at this part. The nail, situated upon a turgid finger or toe, separates more and more, and is ultimately detached; disclosing an angry ulcer, of irregular margin, and smooth, glazed, tawny surface, surrounded by dusky redness, emitting a thin foetid discharge, and the seat of intense pain. Usually, an aborted reproduction of the nail protrudes from the proximal part of the sore. In cases of long standing the distal phalanx has its nutrition so modified, that its periosteal surface becomes spicular, closely resembling the appearance of a head of the Teasel.

The indications of treatment are simple. To remove the stunted nail; to blister the whole circumference of the ungual phalanx, or by an escharotic—as the potassa fusa or nitric acid—to destroy the morbid texture of the matrix; and, on separation of the slough, to make such application to the sore as its varying state may seem to require. In almost all cases, however, local treatment is not alone sufficient. The general health will be found greatly disordered. Alteratives and tonics are necessary; and, in some cases, when of syphilitic origin, a mild mercurial course is followed by the best effects.

Certain cases are very obstinate, and to such the term *Onychia maligna* has been applied; inappropriately, however, inasmuch as the sore, however unmanageable, possesses none of the characters of true malignancy. In such cases, the escharotic application must be made with unusual intensity, not only to the surface of the ulcerating matrix, but fairly within the cutaneous reflexion constituting the root or posterior part of the matrix; or, under chloroform, the diseased parts may be, in the first place, fairly exposed by means of the knife; and if, by this

means, a satisfactory granulating surface cannot be obtained, it is well, instead of performing amputation of the phalanx, as was formerly practised, more especially in those examples of the inveterate form in which the bone has become involved, to resort to repeated blistering of the part till all thickening of the textures is fairly removed.

Onyxis, or In-growing of the Nail.

This in-growing of the nail rarely occurs but in the great toes. It may be produced simply by the undue pressure of a too tight boot or shoe. It presses the fleshy side of the toe against the side of the nail, and by the constant fretting and rubbing to which the part is exposed in walking, the textures become swollen, red, very painful, and ultimately ulcerated; large flabby granulations usually bulging out from the matrix over the surface of the nail. In other cases the patient is himself the cause. He has cut the toe nails round in their free extremity, instead of paring them squarely. The new nail, as it pushes upwards and outwards, is thus broader than the opening in the soft parts through which it has to advance; and consequently pressure and motion maintain and aggravate the irritation till suppuration takes place, and the matter is discharged at the side of the nail.

Whether the nail have been originally to blame, or not, it is very important to remove its injurious contact with the angry sore along its margin. For this purpose, either mild or rude measures may be employed; the former in the first instance. The nail is softened, and having been scraped thin, has its edge gradually and gently elevated above the fungous granulations; and then there is interposed a layer of soft lint, or other suitable substance. The nail having been thus permanently elevated, the freed sore abandons its irritable character, and may be brought to heal under the ordinary applications. But, failing such measures, evulsion of all that portion of the nail concerned in the ulcer is to be had recourse to, as first employed by Dupuytren; a very painful, but very effectual remedy. The nail having been softened and thinned as before, the blade of strong sharp-pointed scissors is run up from the point to the root; the nail is severed at that part by one stroke; the isolated portion of nail—usually about a quarter of the whole—is then laid hold of by strong dissecting forceps, one blade of which is pushed beneath; and by a sudden wrench, evulsion is effected. Unless under chloroform, the pain is great, though momentary. Hot poultice or water-dressing is applied. A healthy character of sore, generally, soon appears; and healing is not long delayed.

Contraction of the Palmar Fascia.

The whole aponeurosis may be rigidly contracted; or that portion only, connected with and passing along one or more fingers. When the whole is involved, all the fingers are rigidly bent, and the hand consequently is not only much deformed, but almost entirely useless. The disease is most frequent in those who in using the fingers much, keep them for a considerable period in the contracted position. It is but little

amenable to treatment. Obviously the change depends on a chronic inflammatory process affecting the aponeurosis ; and is to be met in its early stage with leeching, mercurial friction, local use of iodine, etc. The partial form is common in those of the better ranks, who are much given to horseback exercise, and other field sports. In some of these cases, amendment may follow subcutaneous division of the affected portion of fascia, the finger being subsequently straightened by the application of a splint and bandage.

Spastic Flexion of the Thumb not unfrequently occurs during childhood, in connection with intestinal irritation. It is treated by the application of splint and bandage, while by purgatives and alteratives the primæ viæ are rectified.

Those who write much are liable to troublesome spasm of the thumb—sometimes called “*Writer’s cramp*”—or to the opposite condition, “*Scrivener’s palsy*.” Treatment consists in rest, friction, and Faradization of the part, with tonics constitutionally and locally.

Tumours of the Metacarpal Bones and Phalanges.

Exostosis may occur ; but is rare. Treatment is seldom if ever required, the affection proving but little troublesome. *Osteo-cystoma* is more common. Its treatment depends upon the bulk. If small, it is incised ; and, on pressure being subsequently applied, contraction and healing will probably ensue. Or, if need be, a seton is passed and temporarily retained ; and thus the desired obliteration is effected. Those of large size, involving the whole periphery of the bone, warrant amputation of the affected part. *Enchondromata* have here their most frequent site. If small and external, the tumour may sometimes be dissected off, and the bone left uninjured. Those which affect the whole bone, and develope from its interior, require amputation. Generally, the tumours are not single ; yet usually we are able to save a part—and sometimes the greater part—of that most useful organ, the hand ; the avowed non-malignancy of this tumour admitting of incisions being made very close to the morbid formation. Sometimes, however, the size and connections of the tumour are such as to demand amputation of the whole hand. Once I had occasion to remove one of great size, weighing fourteen pounds. From the apex of the tumour repeated and serious hemorrhage had taken place ; and it was satisfactory to find, on a careful examination after injection, that the blood had escaped from ulcerated openings in large superficial veins, not from any degeneracy in the structure of the tumour itself.

Other Diseases of the Metacarpal Bones and Phalanges.

These bones are especially liable to the inflammatory casualties—ulcer, caries, and necrosis. The ordinary treatment is to be put in force. When, as a last resource, amputation is unavoidable, one general rule should never be forgotten, viz., that it is our duty to save as much as circumstances will possibly permit—a portion of the original hand being

a much better organ of prehension, than any artificial substitute, however ingeniously constructed.

Frequently, in consequence of whitlow, or inflammatory change traumatically induced, it may be in our power to retain a finger, but not without complete ankylosis of all its articulations. And, under such circumstances, it comes to be a question whether it were not better to



Fig. 304.

amputate such a member at once, before ankylosis and cicatrization have occurred ; thereby not only shortening the cure, but also rendering the hand much more useful—

especially in the case of the labouring man, by whom a stiff finger is felt to be constantly in the way. I believe that the question is to be answered in the affirmative—in favour of amputation. The thumb, however, is in all circumstances to be preserved, if possible. Rigid or not, it proves extremely serviceable.

Another question arises in the case of a hopelessly diseased metacarpal bone, whose corresponding finger is perfectly sound. May the metacarpal bone be removed alone, or must the finger be taken along with it? The latter is the preferable practice. The finger left without its metacarpal bone is worse than useless.

Two or even three metacarpal bones, when carious, may be removed, with their corresponding fingers. The operation is preferable to amputation of the whole hand. For, the paramount general rule of saving as much as possible, should ever be respected in such cases. Some years ago, in amputating a metacarpal bone, its base was found carious, and also the corresponding portion of the carpal range. The latter diseased part was removed by means of a gouge ; and a most satisfactory cure resulted.

Hypertrophy of the Fingers.

This rare departure from ordinary nature has been occasionally noticed in young people ; affecting one or more fingers ; originating from no assignable exciting cause ; consisting of true hypertrophy of all the textures—bones, joints, tendons, skin, and nails ; and accompanied with more or less deformity, and loss of function. Firm and continued pressure may moderate the unnatural growth. If not, inconvenience may be mitigated by amputation—partial or complete.

Congenital Deformities of the Hand.

Supernumerary Fingers are usually attached, not by articulating apparatus, but by ordinary integumentary tissues. Their amputation is accordingly very easily effected, by knife and elliptical incision, or by curved scissors.

Webbed Fingers are often hereditary ; and in some parts of the country are held in esteem. Sometimes the adjoining fingers are fused together, the two nails uniting in one—their duality being marked only

Fig. 304. Scrofulous necrosis of finger ; macerated ; after amputation.

by a central groove. In such a case, nothing need or can be done, the fingers being more useful when united than they could be otherwise. Should an actual web of union exist, and should separation be wished, that is obtained by division of the abnormal band; great care being taken, during cicatrization, to prevent reunion of the opposed parts. And, for this purpose, interposition of dressing is not enough; it is essential, as in the case of burns, to make constant and considerable pressure on the angle of union, at the knuckles; and this is done by means of a piece of cord or tape, placed and retained there. Ingenious devices have been employed, to secure cicatrization of the angle of the fingers before effecting the division of the web. Thus, a piece of metal has been introduced through an aperture, and retained there, its size being gradually augmented by fresh additions, till cicatrization is secure at the point of natural union; then the rest of the web is severed. By some, a flap of cutaneous texture is transplanted, so as to occupy the angle of convergence, after the ordinary operation of division of the web has been completed.

Club-hand, a condition analogous to club-foot, occasionally occurs, congenitally. It is remediable, at an early age—with or without the aid of tenotomy—by the wearing of suitable apparatus. In dividing the tense tendons, this should not be effected in the hand or fingers, but above the annular ligament of the wrist; each tendon being divided separately, as thus all risk of injury to the median nerve is prevented. Afterwards, the management of such cases is usually intrusted to the machinist. And it is also the province of that profession to atone, by mechanical substitutes, for *deficient development* of the hand or fingers.

CHAPTER XLIX.

DISEASES OF THE ARTICULATIONS OF THE SUPERIOR EXTREMITY.

Disease of the Shoulder-Joint.

THIS joint is liable to the ordinary affections of such parts. But it is perhaps especially liable to disorganizing disease, involving all textures ultimately, and usually originating in the cancellated tissue of the head of the humerus. To this the term *Omalgia* was formerly applied; very inappropriately, because apparently inferring that the disorder was of the nature of irritation, or neuralgic, not structural and inflammatory. It may occur at any age; and very frequently its origin is connected with external injury. One of the first and most prominent symptoms is wasting of the deltoid; ultimately giving the appearance of prominence to the acromion. The pain extends down the limb, and is most severe at night. There are two parts—one anteriorly, beneath and external to the coracoid process—the other posteriorly, at a corresponding point—to which the patient usually refers the pain in the articulation itself, and where the greatest aggravation of the suffering is produced by pressure. The arm is incapable of exertion; and pain in the joint is increased by motion, especially when the arm is raised. Bending takes place at the elbow; and the limb projects awkwardly from the body, feeble and wasted, sometimes cedematous and congested, and apparently increased in length. The flattening of the deltoid region, the approximation of the tubercle of the humerus to the coracoid, and the abduction of the limb, all closely simulate luxation of the shoulder. And, at length, this result may actually occur; disorganization of the joint having become complete. The constitution does not fail to suffer, in sympathy with the progress of this grave disorder. Swelling, as usual in primary affections of the hard tissues, is of secondary occurrence, and is seldom very great; evacuation of the matter, by external opening, being soon attained by Nature's own effort.

Treatment is to be conducted on the general principles enunciated in speaking of the treatment of diseases of joints generally. But, true caries having been established, with an open condition of the joint, it becomes very improbable that spontaneous cure will take place; and usually the general health is then seriously and obviously on the decline. In such circumstances, the diseased parts must be removed by operation—by resection of the joint, or by amputation of the limb. The former operation is obviously preferable, when not expressly contra-indicated.

Resection of the Shoulder-Joint.

To expose the articulation, a flap may be made from the anterior or posterior part of the deltoid, or by raising the whole muscle as a single flap; or (Baudens) a single incision may be made longitudinally, over the anterior aspect of the head and neck of the humerus—the knife being entered below the clavicle, in the hollow between the coracoid, clavicle, and head of the humerus, and carried down to a point midway between the head of the humerus and the insertion of the deltoid. In most cases, the latter mode is quite sufficient; and, being less severe, is to be preferred. The knife and finger having penetrated the joint, the remaining portions of the retaining apparatus are divided—more especially the muscles inserted into the greater and lesser tuberosities of the humerus, viz., the supra-spinatus and infra-spinatus, and the subscapularis. In this part of the operation the finger is the best guide. The diseased head is at the same time rotated, so as to bring the muscular attachments as near the external opening as possible; and it is then made to show itself, and project through the wound—the limb being with this view carried forcibly backwards. By the saw, abbreviation is made to the required extent. The glenoid cavity is then examined; and, if found diseased, the affected part is taken away, by means of cutting pliers, or by a gouge. To facilitate removal of

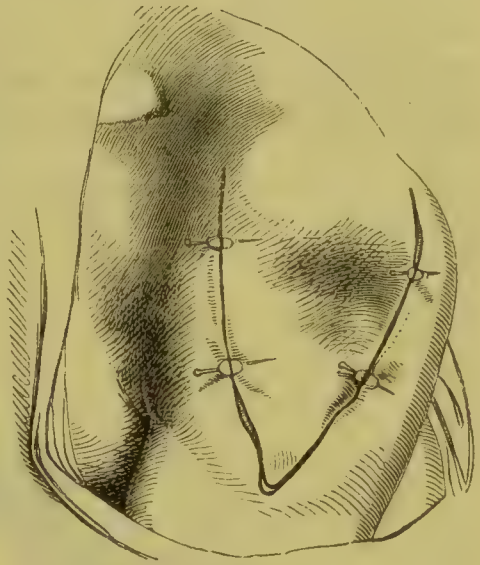


Fig. 305.

the whole glenoid surface, a free incision may be made along the posterior margin of the deltoid, in a direction somewhat analogous to that made in front. Bleeding having been arrested, the anterior and posterior circumflex arteries usually requiring the use of ligature, the parts are accurately adjusted; the wound is brought together, and the limb is retained steadily in a convenient posture. Healing by granulation is to be expected; with the formation of an artificial joint, more or less competent to assume the functions of the original. Often it proves in all respects an admirable substitute. And thus many useful limbs may be retained, under circumstances which, but a few years since, would have called for nothing short of amputation.

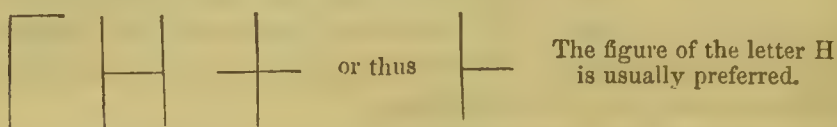
The operation may also be required, primarily, on account of injury done to the head of the bone; as by gunshot wound. Then the incision should be made so as to include in its track the wound of entrance.

Resection of the Elbow-Joint.

Few affections are more common than articular disease at the elbow. And not unfrequently it advances to disorganization; with or without

Fig. 305. Flap, placed in position, after resection of the shoulder-joint.

strumous complication. To this joint, more than any other, the operation of resection is applicable ; care being always taken to select the case according to the ordinary tests ; lest, resection failing, amputation become necessary, and we discover, when too late, that the patient who could have stood one operation well, must inevitably sink under both. It is rare, indeed, now-a-days, to meet with a case where disorganizing change has been allowed to proceed so far as to interfere with the success of excision. The patient having been laid recumbent on a table, the arm is held by an assistant, half-way between flexion and extension ; the joint is exposed from behind, by a single, or *linear* incision ; or by



cutting so as to form flaps ; and these may be either double or quadruple. The *linear incision* should be commenced about two and a-half

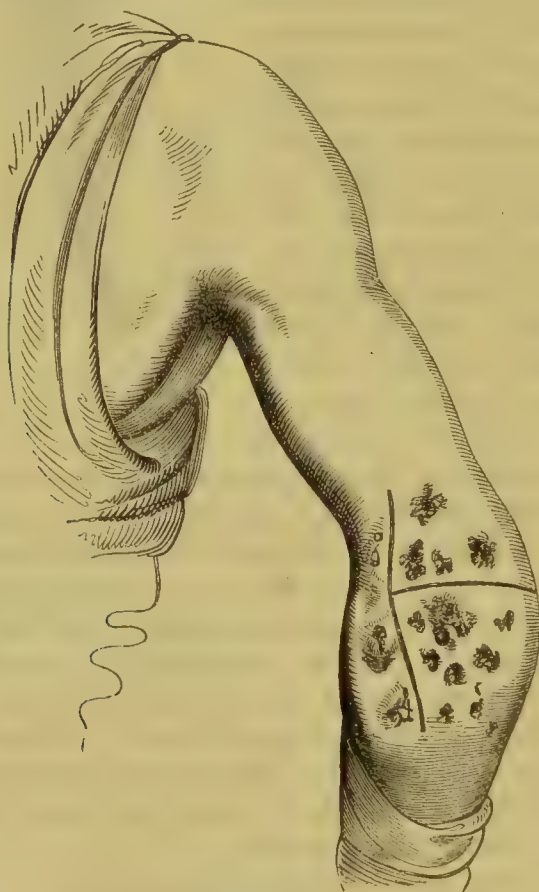


Fig. 306.

inches above the olecranon, and carried nearly but not quite as far below it ; and the knife should be borne steadily down to the bone throughout the whole extent of the wound. The whole of the soft parts on the posterior aspect of the joint are then dissected from the osseous surfaces, taking special care to avoid injury to the ulnar nerve where it lies between the olecranon and inner condyle. When the H incision is em-

Fig. 306. Triangular incision marked for resection of the elbow, on the right arm.

ployed, the operator commences his proceedings by feeling for the inner condyle ; and, placing the nail of the thumb a little to its outer side, so as to keep the ulnar nerve in safety close to the condyle, he introduces his knife at the point marked by the nail, perpendicularly down to the bone, and then carries his incision across immediately above the olecranon to the outer condyle. The two perpendicular arms of the wound are then made, their extent being carried somewhat further downwards in the forearm than upwards over the humerus. The insertion of the triceps having been cut across, on bending the arm the olecranon is made prominent ; and this, having been separated from its connection with the soft parts, is removed by bone pliers, to the requisite extent. The joint can now be very readily dislocated by dividing the internal and external lateral ligaments ; the condyles of the humerus are isolated and sawn off ; and the upper parts of the radius and ulna are also removed—the saw being preferred, to avoid bruising of the softened bone. Removal of the olecranon by pliers is mainly to facilitate disarticulation. Should any suspicious portions appear at or near the cut surface, the gouge may be directed against them, or a fresh slice may be removed with the saw. When the operation is practised for ankylosis, a larger extent of bone should be taken away than in cases of acute progressive disease, as the tendency in the chronic cases to the occurrence of a stiff joint is very much greater. In cases of ankylosis, also, after the posterior aspect of the joint has been exposed, exactly as described, the ankylosed joint may either be forcibly broken up so as to effect disarticulation, or the dense osseous tissue may be cut nearly through with the saw ; and after isolating the bone above and below, first the brachial, and then the radial and ulnar extremities are sawn off.

In other cases, after the preliminary dissection has been carried so far as to disclose the external and internal supra-condyloid ridges, a spatula, or grooved steel director, may be carried across in front of the humerus at the upper end of the incision, and the bone divided upon it by means of the saw. The use of such an instrument is not here to protect the vessels, but to keep the skin safely out of harm's way in applying the saw. The dissection having then been carried downwards in front of the articulation, the joint is now removed entire, the radius and ulna being divided below.

The vessels which require ligature are usually the recurrent ulnar and radial ; but when the disease is acute, and suppuration is either imminent or taking place, the vascularity is always greater, and many more vessels may require to be tied. Bleeding having been arrested, the wound is brought together by sutures, the union of the transverse incision being especially desired when the H incision has been employed. If it does not take place, the ultimate mobility and appearance of the part are not what they might otherwise have been. The limb is secured by a figure of 8 bandage, in a slightly bent posture. No splint is required. Suppuration and granulation occur ; the wound slowly closes ; and an artificial joint by ligamentous structure is ultimately formed—usually of the greatest usefulness.

Resection of the Wrist.

It is easy enough to remove by operation the articulating ends of the radius and ulna, or to gouge or even cut out the affected parts of the corresponding surfaces of the carpal bones ; but the proceeding has not been found so satisfactory as to commend itself to the confidence of surgeons generally. And, consequently, when this joint is deemed irreclaimable, amputation is usually preferred. Fortunately, a vast proportion of the cases of scrofulous disease of this joint, in adolescents, recover under use of cod-liver oil, and general anti-strumous treatment—with or without anchylosis.

When the operation is undertaken, two incisions, one on the outer, the other on the inner aspect of the wrist, should be preferred ; the soft parts on both the flexor and extensor aspects are carefully freed by dissection, and division of the bones is effected by the bone pliers, so as to enable first the one extremity and then the other to be turned out and sawn away. Afterwards a splint is needed ; applied on the flexor aspect, and retained till consolidation of the parts is so far complete as to admit of active and passive motion being attempted. Lately, Professor Lister and Dr. Buchanan of Glasgow have obtained very encouraging results by this mode of procedure.

CHAPTER L.

INJURIES OF THE SUPERIOR EXTREMITY.

FRACTURES.

Fracture of the Clavicle.

THE clavicle is frequently broken ; and usually by violence applied to the acromial extremity, as by falls on the shoulder. The fracture is generally oblique, and near the centre of the bone. The limb is powerless, the part at the seat of fracture is pained and deformed, attempted movement aggravates the pain, and the shoulder is both sunk and drawn towards the sternum. On elevating and depressing the shoulder by moving the elbow, while the hand is placed over the clavicle, crepitus will be experienced.

In children, owing to the incompleteness of the separation at the time of injury, and the lightness of the arm, displacement sometimes does not occur for some days ; the existence of fracture in such cases is therefore easily overlooked.

Displacement is caused by depression of the outer fragment ; whereby the sternal portion is made very prominent, causing palpable deformity, and seeming to be out of place, though truly remaining nearly *in situ*—the action of the pectoral and sterno-mastoid muscles attached to the sternal fragment nearly neutralizing each other, and any degree of elevation being further prevented by the costo-clavicular ligament. The acromial portion is dragged downwards by the weight of the arm ; and forwards and inwards by the action of the pectoralis minor and subclavius—the attachment of these muscles to the ribs being then the fixed point. Fracture may also occur at, or external to, the coraco-clavicular ligaments. In the former instance, the attachment of the conoid and trapezoid ligaments prevents the separation of the bone at the seat of fracture. But in the latter, rotation of the scapula, due to the weight of the arm, still displaces the external fragment so that at the seat of fracture it may form a right angle with the sternal one. Fracture at or internal to the costo-clavicular or rhomboid ligament sometimes happens, but is usually attended by no displacement ; there may, however, be a slight projection forwards, as if sub-luxation had occurred.

The indications of treatment are plain ; the same in all cases, but unfortunately not very easily carried into practical effect. They are to raise the acromial portion to the same level with the sternal ; to retain it there ; and at the same time to keep the shoulder removed from the sternum, so as to prevent displacement inwards of the external portion. Many and complicated means have been devised for this end. The

simplest, most easily obtained, and not the least efficient, are either the pad, sling, and bandage of Desault, or the figure of 8 bandage originally employed by Albucasis. Desault's method is as follows:—A wedge-shaped pad, with the broad end of the wedge uppermost, is placed in the axilla, sufficiently large to occupy the cavity without stuffing it. The pad is best made of horse-hair, covered with soft leather; but any temporary substitute may be taken at the first dressing. By means of a shawl or large handkerchief, within which it is placed, the pad is securely lodged in the axilla; and, by tying the ends to the anterior and posterior aspects of a well-padded handkerchief, which surrounds, collar-wise, the opposite shoulder, the acromion is kept outwards, and along with it the acromial portion of the clavicle. The drooping of the shoulder from the weight of the arm is prevented, by supporting the forearm and elbow by means of a sling; the forearm crossing the chest, and the fingers pointing towards the opposite shoulder. To obtain further extension of the bone, a bandage or handkerchief is applied round the chest—including the lower part of the arm on the injured side—and so firmly fastened that the elbow shall be approximated to the chest; thus making the humerus a lever, which, acting on the pad as a fulcrum, forces the shoulder outwards. By some this method is regarded as either galling to the patient, or inefficient; and by them a more complicated apparatus calculated to fulfil the same indications—a starch bandage without the pad, but applied so as to retain the arm in the position described, with a figure of 8 bandage applied round the shoulders, or padded shoulder straps calculated to act by approximating the scapulæ—is considered preferable, so as to effect and secure adjustment. It is well, in any case, to relax the sternomastoid by attention to the position of the neck; for sometimes this muscle elevates the sternal portion slightly. In cases where any decided difficulty is experienced in keeping the parts in position, the patient should be confined to bed, and maintain the recumbent posture, the shoulders resting on a broad and square firm pillow, with the head supported, while the arm is held in a sling, and fixed to the chest. The application of pressure over the site of fracture should never be resorted to. The integuments may be induced to slough; and an injury, originally simple, may be rendered compound. In females, for obvious reasons, the treatment is to be conducted with especial care.

Fracture of the Body of the Scapula.

The body of the scapula may be broken across by direct violence, or even by muscular force alone. There is usually but little recognisable displacement or deformity; the muscles on the inner and outer surfaces of the bone, and the firm fibrous texture into which the muscles attached to the scapula are inserted, preventing this. Post-mortem investigation usually, however, shows that some over-lapping by displacement of the lower fragment has taken place, by which it passes beneath the upper part of the bone, to the extent of from a quarter to half an inch; in other cases the lower fragment is drawn outwards, the upper backwards and upwards, so that posteriorly they are separated from each other like the limbs of a pair of compasses. The part is pained, swollen, and limited

in voluntary motion ; by carrying the forearm behind the patient's back, the deformity of the projecting scapula will be recognised ; and as the arm is moved backwards and forwards, crepitus can be distinctly felt by the hand placed flatly on the part. In treatment, it is sufficient to restrain motion, either by wearing the arm in a sling, having a broad flannel bandage passed firmly round the chest, including the fractured bone—or by including both the arm and shoulder in a starch bandage.

Fracture of the Acromion.

The acromion process can only be detached from the spine of the scapula by direct violence. The line of fracture is generally posterior to the acromio-clavicular articulation ; but sometimes into, and occasionally external to that joint. The injury is a rare one. The symptoms are nearly the same as those of fracture of the clavicle. There is pain, swelling, and loss of power, more especially in attempting to elevate the arm outwards ; and a depression can be felt at the injured part, as the spine of the scapula is traced outwards, in consequence of the fractured portion being drawn downwards to a greater or less extent on the head of the humerus, by the action of the deltoid muscle. The degree of this displacement depends apparently upon the extent to which the periosteum surrounding the bone has suffered from the injury. By some the clavicle is represented as drawn downwards and forwards on the coracoid process by the subclavius, and by the action of the deltoid and pectoralis major muscles overcoming that of the trapezius and sterno-mastoid ; but such a result could only occur in cases where great comminution and laceration at or internal to the acromio-clavicular articulation had taken place. Crepitus is not felt on rotating the limb, when the acromion is displaced, until the arm has been raised, and the fractured portions brought into apposition. In treatment, it is sufficient to raise the arm fully by means of a sling, and to prevent motion by suitable bandaging to the trunk. No pad should be placed in the axilla ; otherwise the hiatus between the fractured portions will probably be increased. Or, if employed at all, the pad should be a cushion of the wedge shape, with the narrow end upwards, separating the elbow from the side, and thus relaxing the deltoid (Delpech). Union is generally by ligament ; sometimes the surfaces remain separated at the line of fracture.

Fracture of the Coracoid Process.

This, also the result of direct violence, may be occasioned by gunshot injury, and is most commonly observed as a minor complication of more serious lesion of the upper part of the chest and shoulder. The fractured portion is rotated by the action of the coraco-brachialis, pectoralis minor, and biceps muscles ; but cannot be displaced downwards, as it is firmly bound throughout its whole extent by the coraco-clavicular ligaments to the clavicle. The presence of pain, crepitus, swelling, and preternatural mobility of the part, with some loss of power in the limb, will sufficiently indicate the presence of the injury. Treatment consists in the

application of a pad, sling, and bandage, with the same position of the arm as for fractured clavicle.

Fracture of the Neck of the Scapula.

The occurrence of such an accident as fracture through the anatomical neck of the scapula, *i.e.*, separation of the glenoid cavity from the coracoid process and body of the bone, is doubted by most surgical authorities ; but a specimen obtained from a patient who died in hospital under Mr. Spence's care proves that such a lesion may occur. The specimen however is probably unique.

Sometimes fracture passes through the surgical neck of the scapula ; *i.e.*, including the glenoid cavity and coracoid process in the detached fragment ; more frequently, the glenoid cavity is fissured and broken up. This fracture is apparently, in all cases, a complication of dislocation of the head of the humerus, in either the sub-coracoid or the intra-coracoid position of Malgaigne. The detached portion of the scapula is retained in close contact with the head of the humerus ; and both are displaced forwards beneath the coracoid, by the action of the subscapularis and pectoralis major, and of the other muscles connected with the upper part of the humerus. The appearances are those of dislocation ; and it is not till the dislocation has been reduced that, by the impossibility of keeping the head of the humerus in its place, the full extent of the injury has been recognised. In fractures through the supra-scapular notch, when the ligament which converts the notch into a foramen, and the coraco-clavicular ligaments are torn, there will be well marked flattening of the shoulder, palpable prominence of the acromion, and vacancy beneath it ; the limb will be lengthened, the head of the bone will be felt in the axilla, and no crepitus can be experienced until the head of the bone is elevated to its normal level, as is effected in fracture with the slightest effort—a thing very unusual, if not actually impracticable, in dislocation. Then crepitus will be plainly felt on rotating the arm with one hand, while with the fingers and thumb of the other pressure is made deep in the axilla, where the mobility of the coracoid process will be recognised ; then, too, flattening of the shoulder is made to disappear ; but, on letting the arm hang by its own weight, displacement and deformity are reproduced. In treatment, a pad, a sling, and a bandage, as in fracture of the clavicle, are to be employed. It should be remembered, in regard to diagnosis of injuries in the neighbourhood of the shoulder-joint, that fracture of the neck of the scapula has frequently been supposed to have taken place, when dissection has shewn that fracture of a portion of the margin of the glenoid fossa, or of the anatomical or surgical neck of the humerus, has constituted the real injury.

Fractures of the Neck of the Humerus.

1. *Fracture at the Anatomical Neck.*—Occasionally the bone gives way at this point, but not so frequently as below the tubercles. The injury is the result of direct violence ; and is intrascapular. There is but little displacement of the shaft of the bone at the seat of fracture, it being

retained in its ordinary position by the muscles inserted into the tubercles; the separated articular facet of the humerus, usually, from the force which has occasioned the fracture, rotates on itself, so that the cartilaginous lower margin is in contact with the fractured surface of the shaft. Sometimes even impaction takes place, the upper fragment being driven into the cancellous tissue of the lower; a circumstance favourable to osseous and speedy reunion. When there is no impaction, the detached head of the bone may become necrosed; and in that event inflammatory disorganization may be expected, for extrusion of the sequestrum. The symptoms, beyond pain, impairment of voluntary motion, swelling, ecchymosis, and crepitus, are very undecided. Where any deformity occurs, it consists in flattening of the upper deltoid region beneath the acromion, and slight shortening of the arm. The crepitus in such cases is most easily felt when the deltoid region is grasped beneath the acromion in an antero-posterior direction, or when the fingers are lodged in the axilla while the thumb is placed beneath the acromion, and adduction and abduction, with rotation, are effected as gently as possible.

2. *Fracture, by Separation of the Epiphysis.*—This also is the result of direct violence, and only occurs in young persons before osseous union of the epiphysis to the shaft is complete. The head of the bone remains in its place; while the shaft is carried forwards beneath the coracoid process, by the action of the muscles inserted into the bicipital ridges. There is no flattening of the shoulder beneath the acromion; the head of the bone can be felt *in situ*, motionless on rotation; the end of the shaft—directed obliquely upwards, inwards, and forwards—is felt and seen projecting beneath the coracoid process; the arm is not shortened, for the broad fractured surfaces rarely pass clear of each other; there is no projection of the elbow from the side; by slight extension and coaptation with the fingers in the axilla, adjustment is readily effected, and then crepitus is emitted on adduction and abduction with rotation. The most characteristic sign is the remarkable prominence beneath, and to the outer side of the coracoid, produced by projection there of the end of the lower fragment of the bone at the seat of fracture; the projecting end is sometimes so marked as almost to have penetrated through the skin, and when reduction is effected the retreating bone sometimes dimples in the skin along with it. When impaction occurs, the signs of injury are necessarily obscured by the lower fragment being driven into the upper, so diminishing the degree of transverse displacement.

3. *Fracture at the Surgical Neck.*—This is also the result of direct violence. The upper fragment remains nearly in its place, its fractured surface moved more or less completely upwards and outwards by the action of the muscles inserted into the tubercles. The upper end of the lower fragment, or shaft, is drawn upwards and close to the side by the muscles inserted into the bicipital ridges; its lower end, at the elbow, is abducted by the action of the deltoid on its point of insertion, while the limb is shortened by the muscles which pass from the scapula to the humerus. The appearances consequently are—no flattening of the upper deltoid region, on the contrary rather a fulness beneath the acromion; the head of the bone felt plainly *in situ*, motionless on rotation; the upper end of the shaft at the seat of fracture felt displaced towards

the side, when the fingers are placed in the axilla and the arm abducted, and a depression plainly perceived at a corresponding point in the external outline of the limb; the arm powerless and shortened; the elbow slightly abducted, more especially if the fracture is oblique; and crepitus, on rotation after adjustment. When impaction in this form of fracture takes place, the upper and inner part of the shaft is driven into the cancellated texture of the head of the bone; and then the characters of the injury are less distinctly marked. In such circumstances, by grasping firmly the head of the bone so as to fix it, by both hands if need be, while an assistant firmly rotates the elbow, the crepitus characteristic of fracture will seldom fail to be elicited.

4. *Fracture of the larger Tubercle.*—This is the result of direct violence. The deltoid region is flattened and remarkably increased in width, sometimes appearing nearly twice as broad as in the normal state; the acromion projects somewhat, but the finger cannot be sunk into the glenoid cavity; the arm, powerless as to elevation, hangs slightly separated from the side, but easily approximated to it; and two hard swellings are to be felt; one, the larger, a little internal to and beneath the coracoid process, is the rounded head of the bone; the other, beneath the acromion, is the detached tubercle, the bicipital groove marking the line of separation. The symptoms closely resemble those of sub-coracoid dislocation, but are easily distinguished by the ease with which the deformity and displacement are partially, but not completely, removed, and by the greatly increased width of the deltoid region.

Treatment of Fractures of the Neck of the Humerus.—The indications here are threefold; 1st, To prevent displacement of the upper part of the shaft of the bone inwards towards the coracoid; 2d, To brace and keep the fractured surfaces in contact; and 3d, To maintain repose during consolidation. The practical details may be carried out in different ways, according to the site of the fracture and the degree and nature of the displacement. In most cases, the angular pad in the axilla, a sling to support the wrist, the elbow pendent to effect extension by its weight, while the arm is confined against the side by the broad bandage encircling both it and the chest, will be found suitable, and easily obtained and applied. Some surgeons, as a means of securing more efficient repose, recommend a horse-hair cushion about six inches wide, extending from the axilla to a little above the inner condyle. For the same object Mr. Erichsen recommends a bend-leather splint, about two feet long by six inches broad, doubled upon itself, so that the angle at the double, well padded, fills the axilla, while the rest of the splint occupies the interval between the arm and side. By some surgeons splints are applied on both the outer and inner aspects of the arm, or on the outer aspect alone—as an adjunct to the pad, sling, and body bandage. Such splints can only act upon the lower fragment, and be of use by rendering the limb steadier than it otherwise might be. Their employment should therefore be restricted to the case of restless, irritable, or juvenile patients.

Cases sometimes occur where, from the completeness of the displacement of the upper fragment by rotation upwards and outwards, coaptation of the fractured surfaces can only be secured by completely abducting

the arm. This position may be maintained by laying the arm on a pillow at right angles to the patient's body ; or by the use of Tyrrell's rectangular splint, one limb of which rests against the side, while the arm is laid upon the other.

Fractures of the Shaft of the Humerus.

These occur most frequently below the middle of the bone, and are occasioned by direct violence, by falls on the elbow or hand, or by muscular contraction—as in epileptic seizures, in the endeavour to support the body when falling, by seizing some object, in the effort to throw a stone, or in “turning over” an opponent's wrist. The fracture is usually transverse, but frequently oblique ; in the former instance there is little displacement, and no deformity, owing to the uniform manner in which the biceps, triceps, and brachialis anticus muscles support the bone ; in the latter, the direction of the obliquity, together with the site of the fracture, and the degree of violence by which the lesion has been occasioned, determine the direction and amount of displacement and distortion. The direction of the obliquity is usually from above downwards and outwards. When the fracture occurs at the insertion of the muscles into the bicipital ridges, both fragments at the seat of injury incline inwards ; below this point and above the insertion of the deltoid, the upper fragment is drawn inwards, and the lower very decidedly outwards and upwards. Below the insertion of the deltoid, the upper fragment retains its position, or projects outwards, while the lower, acted on by the weight of the forearm, projects forwards. The ordinary signs of fracture are readily recognised, more especially flexibility of the limb, mobility of the broken bone at the seat of the injury, and crepitus. In the prognosis and treatment of fractures of the shaft of this bone, the possibility of the occurrence of want of union between the fragments, of a considerable amount of deformity, and sometimes of very considerable inflammatory excitement, should not be forgotten. The treatment consists in applying splints to the inner and outer aspects of the limb, extending from the axilla and acromion, respectively, to the condyles of the humerus, and secured either by a roller or tie-bandage. The forearm should be flexed at a right angle, and supported in a sling, while by a cushion placed between the arm and side, extending from the axilla to a little above the condyles, and a body bandage encircling the arm and chest, the whole is rendered immovable. When the fracture is situated low down in the shaft, or there appears to be a probability of want of union resulting, rectangular splints, including both the arm and forearm, supported by a starch bandage, should be applied. When inflammatory symptoms occur, the hand and forearm should be supported by a roller bandage, and it is generally well to confine the patient to bed till all irritation has subsided. Various plans have been devised to maintain forcible extension ; but they must be regarded as dangerous or unsatisfactory.

Fracture of the Lower Extremity of the Humerus, Supra-condyloid Fracture.—Here the solution of continuity is generally oblique ; sloping downwards from behind forwards. And the appearances simulate those of dislocation of both bones of the forearm backwards. The lower frag-

ment is carried upwards and backwards along with the bones of the forearm. The limb, as measured from the acromion to the outer condyle, is shortened; and at the elbow there is much bulging posteriorly, with projection of the extremity of the upper fragment forwards above the fold of flexion of the joint. On gently extending the forearm with one hand, while the lower end of the humerus is supported by the other, the deformity is removed; but it is instantly reproduced on leaving the limb to itself; and by this test the accident is sufficiently distinguished from dislocation. Crepitus and mobility may be plainly perceived when the elbow and lower part of the humerus is supported in the grasp of the left hand, and the elbow is flexed and extended. When the line of fracture follows an opposite direction, passing obliquely upwards from behind forwards, the displacement is reversed; the lower end of the upper fragment projecting behind, while the prominence in front is produced by the upper end of the lower fragment. Reduction having been effected, rectangular splints are applied on the inside and outside of the limb, and are retained by bandaging; the rectangular position of the forearm being obviously advisable, in order to relax the biceps and brachialis anticus, as well as to prevent the straight position of the limb, which would at once, through the weight of the forearm hanging perpendicularly from the shortened continuity of the humerus, place the lower end of the bone in an angular relation to the upper. The splints—made of pasteboard, leather, or gutta-percha—should extend from the shoulder to the wrist.

Diastasis may occur in young children; the epiphysis being detached, with or without rotation. Reduction having been effected, by extension and coaptation, retention will be maintained in the bent position by a figure of 8 bandage, securing a pad of lint placed in front of the elbow, and applied so as to support and include the one-half of both arm and forearm.

Fracture above the Condyles complicated by Fracture into the Elbow-Joint.—This fracture is a mere variety of the one just described, and is attended by virtually the same symptoms—mobility between the condyles, increased breadth of the lower part of the humerus, with crepitus developed when the condyles are moved against each other in different directions. The prognosis should always be more serious, on account of the risk of ankylosis of the articulation resulting from the inflammatory process affecting the joint. In treating this form of fracture, therefore, the risk of inflammatory accession and of ankylosis should be kept in view; sufficient rest being maintained till union is so far completed that passive motion may be commenced without occasioning displacement. For retention, a figure of 8 bandage around the elbow, supporting a pad of lint applied over the front of the articulation, is all that is required. Should such a fracture be compound, or complicated with a wound communicating with its track, excision of the articulating extremity of the humerus should be resorted to, and the arm treated as after resection of the elbow-joint.

Fracture through the Condyles of the Humerus.

1. *Of the Internal Condyle or Trochlea.*—This rarely occurs after adolescence, and is produced by falls or blows on the elbow. The line

of fracture, commencing about half an inch above the epitrochlea, runs in a line oblique to the shaft, and passing through the middle of the articulating surface of the trochlea, detaches the internal condyle. During flexion of the forearm there is little or no displacement; but, on extension, the ulna is carried upwards and backwards, by the weight of the forearm, there being no longer any efficient support to the coronoid process. The signs are—crepitus, on direct lateral movement of the injured part; obvious displacement of the olecranon by rotation, backwards and outwards, in extension, and replacement of it by flexion of the forearm. In treatment, the limb is arranged in a rectangular position, with a pad of lint in front—the whole being supported and maintained by a figure of 8 bandage. But after the first week or fortnight, it is expedient to undo the apparatus from time to time, and practise passive movement of the joint, lest ankylosis should occur.

The *Epitrochlea* or *Internal Epicondyle* may be fractured in children or adolescents, the line of fracture in these cases being extra-articular. Granger (Edin. Med. and Surg. Journal, 1818) ascribes it to muscular contraction, but probably it is always due to direct injury. The fragment may be carried downwards towards the forearm, or upwards and backwards towards the olecranon. In many instances, it undergoes no sensible displacement. Injury to the ulnar nerve may accompany this accident, followed by vesication of the little and ring fingers (Granger). The treatment should be that of flexion of the forearm at right angles, with the pad and bandage already described.

2. *Of the External Condyle.*—The course of fracture, commencing above the line of the capsule of the joint, passes obliquely through the articular surface, either separating the radial articulating facet, or implicating the trochlear surface which articulates with the ulna. The broken portion may pass upwards and backwards, or upwards and forwards. Sometimes while the articular portion, along with the radius, passes backwards, upwards, and inwards, the upper part of the broken fragment projects forwards and even outwards. Or, again, there may be little or no displacement in any position of the limb. But crepitus is to be felt; more especially during rotatory movement of the hand and radius, or by seizing the condyle and moving it backwards and forwards. Treatment is as in the preceding cases, and a like early resort to passive motion should be attended to.

The *External Epicondyle* has been described by some writers as sustaining separation from the condyle. The small size of this process scarcely admits of its suffering from muscular action, or from direct injury apart from the condyle; that is to say, without implicating the articulation, and therefore being virtually a lesser example of fracture of the condyle.

Fracture of the Ulna.

1. *Of the Olecranon.*—This is usually the result of direct injury, by a fall on the elbow; occasionally it has been caused by muscular action only, in violent and sudden extension of the limb. The line of fracture may correspond to the extremity, middle, or base of the process; the middle line of fracture being the most common. In the two first, the

fracture is usually transverse ; in the last oblique, extending from before, backwards and downwards. When surrounding textures retain their integrity, the fragment undergoes no displacement, and the existence of crepitus and mobility, on lateral movement being imposed on the injured parts, alone indicate the existence of a fracture. Usually, however, the ligamentous and fibrous covering of the process is torn ; and consequently, the olecranon, detached from the shaft of the ulna, is displaced upwards by the action of the triceps ; leaving, when the forearm is flexed, a vacant space where a prominence should have been, and placing the prominence an inch or more above its ordinary site. Voluntary extension is impracticable ; flexion aggravates the signs of the injury. On extending the limb, the displacement is in a great measure removed ; the two fragments are brought sufficiently near for satisfactory ligamentous union ; and in treatment, therefore, it is enough to maintain the apposition of the fractured bone by a figure of 8 bandage, and to secure an almost completely extended position by the loose application of a straight wire splint on the palmar aspect of the elbow-joint.

Compound fracture of the olecranon following direct injury, as in gun-shot wounds, is invariably to be regarded as a serious accident, inasmuch as intense inflammatory affection of the joint is very likely to supervene. And this tendency to serious evil we should never lose sight of, in treatment ; endeavouring to prevent traumatic arthritis, if possible ; and when it has occurred, doing our utmost to avert disorganization. Not unfrequently, with the best care, the joint suppurates. Should this occur, excision of the joint should at once be had recourse to ; the inflammatory fever, if present, being checked by the incisions requisite for the operation, as well as by the relief to irritation and tension effected by the removal of the articulating ends of the bone. We have, however, in one such case—instead of practising excision—removed numerous fragments of the shattered olecranon, and a portion of the bullet by which the injury was inflicted, with the result of the suppuration gradually subsiding, and the parts being restored to a useful condition with a very considerable degree of freedom of motion. Fracture of the olecranon may be complicated with wound of the bursa over the process ; and the diffuse suppuration which ensues, attended with a dense brawny swelling of the arm and forearm, may closely simulate the implication of the cavity of the joint. Here, free dilatation of the aperture communicating with the bursa, will usually check further inflammatory progress, and serve to indicate the less serious nature of the case.

2. *Of the Coronoid process.*—This accident, if it ever occurs, must be excessively rare. No doubt cases have been reported as of this nature, by very reliable authorities—examples for the most part of dislocation of both bones of the forearm backwards, difficult of retention after easy reduction, and with a feeling of crepitus on pressure over the coronoid process. Further, also, specimens have been met with in autopsies, or in museums, where the point of the coronoid process has been united to the shaft of the ulna by fibrous tissue. The first line of proof is, however, a very precarious one ; as fracture through the inner condyle of the humerus would produce the same phenomena ; while, in the second, chronic rheumatic arthritis might have been the cause of change. Again,

Malgaigne has found the process fractured in most instances of dislocation of both bones of the forearm backwards, which have been artificially produced; and Mr. Fergusson has stated—though apparently on no sufficient grounds—that in cases of dislocation of both bones of the forearm backwards “the coronoid process will probably be broken.” That it should occur rather in young than adult patients, and be produced by muscular action, as is implied by Mr. Liston in mentioning the case of a boy of eight years of age, who hung by one hand to the top of a wall for some time, afraid to drop down, and in whom he detected this injury, would seem to imply two anatomical errors—that the coronoid has a separate centre of ossification, and that the brachialis anticus muscle is inserted only into its tip. Without, therefore, absolutely denying its existence, we have never seen this injury, and do not feel satisfied as to the reported cases where it has been supposed to have occurred. If it ever happens it could only be produced either by inordinate muscular action, or by any cause sufficient to bring the part in violent contact with the trochlea of the humerus. Were it to occur, the ulna would tend to pass backwards, the weight of the forearm being unresisted by the brachialis and coronoid, and the tendon of the biceps would be felt stretched over the articulating end of the humerus, while the brachialis anticus would either draw the coronoid process above the trochlea of the humerus when the arm was extended, or retain it lying over the articulating surface; admitting of crepitus being experienced only when the displacement was reduced, and the forearm flexed on the arm, while pressure was made over the site of the fractured process. In treatment, the forearm is placed in a state of extreme flexion, and retained so by a pad of lint and a figure of 8 bandage, so as to prevent displacement and support the parts. Ligamentous union is usually stated to be expected, partly from the analogy of the case of the olecranon, partly from regard to the morbid specimens of the effects of chronic rheumatic arthritis affecting this process to be found in museums.

3. *Of the Shaft.*—The weakest point of the shaft of the ulna is a little below its centre; but as fracture of the shaft can hardly occur except from direct violence, any part of it is found practically alike liable to suffer. There is usually very little displacement unless the fracture is a comminuted one; any little there is usually takes place in the direction in which the violence which produced the injury tended to force the ends of the bones, and this may be either forwards or backwards, but is generally towards the radius—a circumstance which has probably given rise to the belief that the lower fragment is drawn to the radius by the action of the pronator quadratus muscle. When such displacement exists, a depression is easily felt in running the finger along the outline of the bone, and this can only be obscured by sanguineous and inflammatory swelling. There is neither pronation nor supination of the hand. By pressure along the sharp margin of the ulna, and by attempting to move the ends of the shaft on either aspect of the fracture in different directions, mobility and crepitus are readily perceived. In treatment, coaptation having been effected by direct pressure, splints are applied on the palmar and dorsal aspects; each splint extending from the elbow to the metacarpo-phalangeal joints, so

as completely to command the wrist joint. And, in order to prevent the supposed effects of the pronator quadratus, a pad is recommended to be placed on either aspect of the fractured part, of sufficient size to occupy the interosseous space fully, and so to offer a mechanical obstacle to undue approximation. This, however, is practically either injurious or useless; if the pads are large enough, and the splints firmly enough bound together to force them into the interosseous spaces, so as to keep the ends of the bone from undergoing displacement, the pain and the interruption to the circulation will oblige the apparatus to be taken down; if applied more leniently, the pads can only prevent the upper and lower parts of the splints from being in accurate apposition with the surface of the limb, and hence these fail in maintaining thorough repose of the parts. Fracture of the upper third of the ulna frequently accompanies or complicates a dislocation of the head of the radius forwards; in fact, without some such provision to counteract the unyielding integrity of the interosseous membrane and inferior radio-ulnar ligaments, it is difficult to understand how the head of the radius could enter into the position it occupies in the dislocation forwards. When this complicated injury occurs, after reducing the dislocation and coaptating the fractured ends of the ulna, rectangular splints should be applied on the outer and inner aspect of the arm, extending from the shoulder and armpit to the end of the metacarpal bones; and when the tendency in the head of the radius to pass forwards is very great after it has been reduced, the angle at which the forearm is placed with the arm may require to be even less than a right angle.

4. *Of the Styloid process.*—This process may be chipped off, without other injury to the bone. Nelaton describes this injury, and laceration of the triangular ligament, as a common accompaniment of fracture of the lower part of the radius. There is little indication for treatment beyond rest of the forearm and hand in splints, until pain and swelling have subsided.

Fracture of the Radius.

In this injury, it is convenient to observe, as an aid in diagnosis, that there is invariably abnormal pronation of the hand; whether the bone have suffered alone, or in company with the ulna.

1. *At its Neck.*—This is an accident of very rare occurrence, and difficult diagnosis. The fragments are but little displaced, and crepitus has to be detected through a thick cushion of muscular substance. The lower fragment is tilted forwards and inwards slightly, by the action of the biceps; the upper is rotated somewhat outwards by the supinator radii brevis. Crepitus is to be sought for by firm pressure over the site of suspected fracture, while free rotation is made of the hand and forearm. In treatment, the forearm is flexed, and placed in the middle state between pronation and supination; long rectangular splints being applied on either aspect of the limb, or a single splint placed on the external aspect of the forearm, with a pad over the radial surface at the bend of the elbow, secured in its position to the splint by means of a figure of 8 bandage.

2. *Near the Centre.*—The radius sometimes gives way near its centre,

from indirect violence, as by falls on the hand, or by twisting of the forearm. And sometimes the accident is the result of direct violence, or even of muscular action alone. The unnatural degree of pronation is very marked and characteristic, the hand hanging awkwardly with the thumb directed downwards. The upper fragment is displaced upwards and inwards, by the action of the biceps, and rotated into the position of complete supination when the seat of fracture lies between the insertion of the biceps and pronator radii teres; in all cases there is an apparent enlargement of the upper with a diminution of the lower half of the forearm. The lower portion of the fractured bone is drawn towards the ulna, as well as completely pronated, by the action of the pronator quadratus. And the supinator radii longus assists powerfully, by tilting up the styloid process to which it is attached, in displacement towards the ulna. Sometimes the ends of both fragments are depressed towards the ulna; sometimes they incline either forwards or backwards, according to the direction of the violence at the seat of fracture. In treatment, the forearm is flexed, and placed in the middle state between pronation and supination; the long splints are applied on either aspect, extending beyond the knuckles; the hand, bandaged separately to prevent congestion, is excluded from the retentive apparatus, and left pendent—so that by its weight it may counteract the displacing tendency of the long supinator, and separate the radius from the ulna at the point of fracture. Lonsdale suggests that in those cases where the fracture exists between the insertions of the biceps and pronator teres, the treatment should be conducted with the forearm placed in the position of complete supination, so that the lower end of the radius may be brought into accurate relation with the supined upper fragment of the bone. The difficulty which interferes with this being satisfactorily carried out in practice, consists in the impossibility of maintaining the completely supined position of the forearm, without the use of a rectangular wooden splint applied upon the anterior aspect of the arm and forearm. When the displacement, in cases of fracture in this situation, is well marked, the surgeon may lay his account with some deformity resulting from treatment, however carefully this may be conducted.

3. *At the Distal Extremity.*—This, which is the common fracture of the bone, is produced by falls on the palm of the hand. The radius, being mainly concerned in the carpal articulation, sustains the shock of the fall, and the wrench of the anterior radio-carpal ligament. The line of fracture varies from half an inch to an inch above its articular surface, and is in most cases transverse, sometimes oblique from without inwards, and more rarely from before backwards and from below upwards. The upper fragment is not displaced, but retains the completely pronated position it occupied at the time of injury; causing an abnormal prominence on the palmar aspect, with a corresponding depression on the dorsal. The lower fragment is displaced backwards, and its articular surface rotated upwards and backwards, so as to cause a prominence continuous with the carpus on the posterior surface of the forearm. The hand, following the displacement of the lower fragment of the radius backwards, leaves the styloid process of the ulna unusually prominent—as if dislocated inwards and forwards. This fracture has very

frequently been mistaken for the extremely rare injury—luxation of the carpus. The diagnostic marks are—detection of crepitus, mobility at the injured part, and non-continuity of the bone as evinced on rotation. But the case becomes obscure when the line of fracture is oblique, and *impaction* has occurred. The lower fragment having received the sharp posterior laminated margin of the upper into its cancellated tissue, the two become locked; so that, while deformity is present, continuity of the bone is apparently restored, and crepitus is felt but obscurely, if at all. When in doubt, let the displaced extremity of the radius be restored to its normal position by pressure applied directly over the styloid process, and then, if fracture exist, its ordinary signs will be evinced. In treatment, it is necessary to be very careful to effect accurate coaptation by reduction; then to apply splints on the dorsal and palmar aspects, securing the forearm and hand against every motion. The forearm is placed in the state of easy flexion. Still further to protect the lower fragment from displacement upwards and backwards, various devices have been fallen upon by different surgeons. In all, the hand is made the lever, and the end of the ulna the fulcrum. Thus, Dupuytren and Sir A. Cooper recommended, along with the palmar and dorsal splints, a narrow ulnar splint, curved at an angle, so that the hand might be inclined inwards over the extremity of the ulna. Nelaton employs two forearm and hand splints, curved in the part corresponding to the hand, so as to resemble the butt end of a pistol. Hamilton (Buffalo) recommends a splint applied to the flexor aspect of the forearm and hand as far as the metacarpus, the hand portion curved towards the ulnar aspect, and a shorter splint applied on the extensor aspect of the forearm and reaching to the middle of the metacarpus. In addition to adduction of the hand, others have recommended partial flexion, effected by means of a well padded flexible metal splint, over the extremity of which the fingers are maintained in a flexed position. It has even been proposed (Fauger of Copenhagen) to treat this fracture without splints. The hand having been brought into a position of strong flexion, the forearm is placed, pronated, on an oblique plane, with the carpus highest, the hand being permitted to hang freely down the perpendicular end of the plane.

For ourselves we have long used, with satisfactory results, flexor and extensor splints which are made gradually narrowing from the upper to the digital extremity, being, however, at no part narrower than the width of the forearm at the wrist. After being well padded with cotton wadding—and the displacement having been thoroughly rectified—the splints are placed in position; and the bandage having been applied to the site of the fracture, the ring and little fingers are drawn out between the ulnar margins of the splints, and kept there, the bandage including only the thumb, with the fore and middle fingers, within the grasp of the apparatus. In this way the adduction of the hand is quite satisfactorily attained, while the pressure of the dorsal splint, without being inordinate or painful, prevents the reproduction of any displacement.

Fracture of both Radius and Ulna.

This is ordinarily the result of direct violence, but is also occasioned by falls on the palm or back of the hand ; and the fractures consequently are at corresponding points—near either the middle or the lower third of the forearm. The fragments may be displaced forwards, backwards, or laterally, and rarely pass clear of each other. When this, however, occurs, the lower fragments usually are placed at right angles with the upper, and occupy the interosseous space both in front and behind, lying between them. Those who believe in muscular displacements have described pronation of the hand, and approximation of the lower fragments towards each other so as to occupy the interosseous space, by the action of the pronator quadratus ; but this displacement towards the interosseous space, which certainly is observed in museum specimens, is really produced by the injudicious application of a roller bandage to the forearm before applying the splints. The deformity of the forearm, and the crepitus which is easily recognised when rectifying it, whether by coaptation or extension and rotation, sufficiently indicate the nature of the injury. The treatment is, as for single fracture, by long splints, which should be of the same width, and neither broader nor narrower than the forearm. By some, interosseous pads are still employed, with the object of preventing displacement towards the interosseous space. These, however, are, for the reasons already stated, not required. Were such displacement present, the pads would either be injurious from the undue pressure interfering with the circulation of the forearm, or inefficient from being loosely applied, and then by their presence interfering with the accurate adjustment of the all important splints.

In young persons, both bones not unfrequently give way *at their epiphyses* ; an accident which closely simulates luxation of the carpus. Like fracture of the radius alone, it is usually the result of indirect violence, by a fall on the hand. The radial aspect of the lower fragments, with the carpus, is displaced backwards ; the ulnar remains *in situ*, or even lies in front ; the upper fragment of the radius projects towards the flexor aspect, the upper end of the ulna maintains its position. The hand usually remains in the middle state between pronation and supination. Considerable power is required, by extension, or (better) by direct pressure, or by bending the wrist and lower part of the forearm over the knee, to undo the locking and displacement ; and then crepitus is emitted. In treatment, coaptation, having been accomplished by efficient extension, is maintained by two splints, as in the other fractures of the forearm. It should be remembered that in fractures of both bones occasioned by great violence, especially if they have been accompanied by considerable displacement, intense inflammatory engorgement is apt to ensue ; and that no fracture is more likely to be followed by gangrene as a complication, especially where undue pressure has been employed in the use of apparatus.

Fracture of the Carpal and Metacarpal Bones.

The *Carpal* bones are seldom fractured but by great and direct force ;

and then the fracture is not only compound, but also generally accompanied with such injury to other parts as to call for amputation. The *Metacarpal* bones, however, may give way by force, either direct or indirect; most frequently the latter—as from the force of violent blows, delivered in pugilistic encounters, reacting on the knuckles. The metacarpal bone of the thumb may be broken from direct or indirect violence, but usually from falls upon the part when fully extended.

The fracture generally occurs near the distal extremity of the bone. The digital fragment is always displaced towards the palm. The prominence of the knuckle is lost, and the fractured end of the bone forms instead a sharp projection on the back of the hand behind the general line of the knuckles. In the thumb the same displacement occurs, but some degree of lateral displacement may also exist. The deformity, pain, and powerlessness of the finger or thumb, with characteristic crepitus on adjustment and manipulation, are sufficiently indicative of the nature of the injury. Coaptation is effected by extension, and is secured in the case of the thumb by means of two splints—one on the posterior aspect, consisting of wood not broader than the part, and extending from the wrist to its extremity—and the other on the volar aspect, of pasteboard cut to the form of the thumb and volar mass of muscles. These splints are padded, and retained by means of a narrow bandage applied as a roller from the distal extremity towards the palm, and then arranged as a spica bandage, to include the wrist and metacarpal portions of the splints. In the case of the metacarpal bones of the fingers, a splint on the dorsal aspect of the hand and fingers, with interosseous pads arranged on each side of the fractured bone—and on the palmar, one large and suitable pad to occupy and maintain the hollow of the natural arch of the hand—may be employed. Without splints, a ball of worsted or cotton, or a pad of tow, large enough to occupy fully the grasp, is placed in the palm, with the fingers and thumb folded over it and retained in their position by means of a roller bandage or straps of adhesive plaster; and this plan will be found more comfortable, more easily applied, and equally efficient.

In compound injuries of this part, amputation is to be had recourse to with reluctance. When it is inevitable, let it be as partial and limited as possible, for the obvious reasons formerly stated when treating of amputation on account of disease.

Fracture of the Phalanges.

Fractures of the phalanges are usually compound. But, whether compound or simple, their marks are so plain as to render mistake under any circumstances impossible. There is never any occasion for resorting to amputation for a mere compound fracture of the distal phalanx; although, of course, if the soft parts are at the same time stripped off and the broken bone left projecting and uncovered, this should be done by dissecting back the soft parts as flaps, and cutting through the bone at a point where it will be efficiently covered. When preservation of the injured part is deemed practicable and expedient, reduction is carefully effected; and coaptation is maintained by slender splints of wood,

padded with lint, placed on the dorsal and palmar aspects. When the proximal phalanx is fractured, and it is found difficult or impossible to retain it in position by means of splints, the worsted ball, large enough to occupy the palm of the hand and grasp of the fingers, as already described for the treatment of fracture of the metacarpal bones, may be advantageously substituted.

DISLOCATIONS.

Dislocation of the Clavicle.

1. *The Sternal Extremity* may be displaced forwards, or upwards, or backwards. *a. Forwards.*—Dislocation forwards is by much the most frequent, but compared with fracture of the clavicle is a rare injury. It is produced by violence acting indirectly, as by falls or blows on the shoulder. The displaced extremity is seen and felt plainly resting in front of the upper bone of the sternum, while the sterno-mastoid muscle stands out in bold relief, and the shoulder is depressed. The sterno-clavicular and costal ligaments are always torn, and the intra-articular fibro-cartilage may either be displaced along with the clavicle or retain its attachment to the sternum. Replacement is easily effected by raising the shoulder, and by carrying it backwards so as to approximate the scapulæ, while pressure is applied over the dislocated head of the bone. The difficulty in all these cases consists in keeping the bone reduced. Various devices have been suggested to attain this end ; but a figure of 8 bandage to keep the shoulders moderately approximated, or a pad applied over the sternal end of the clavicle, and retained in position with a figure of 8 bandage, with, in either case, a sling to keep the elbow and forearm thoroughly supported, will be found quite as satisfactory and less irksome than any other. A Salmon-and-Ody spring truss, with the well padded head applied over the end of the bone, the counterpad resting behind between the shoulders, and the spring passing below the armpit, may be tried where continuous repression seems necessary. The case of oblique fracture, extending from within outwards and from before backwards through the head of the clavicle, is liable to be mistaken for dislocation. *b. Upwards.*—This is a very rare form of injury. In it the sternal extremity of the bone occupies the supra-sternal space, on a higher or lower level ; sometimes close above the sternum, and in contact with the sternal portion of the opposite sterno-mastoid and sterno-hyoid muscles behind ; in other cases elevated as high as the level of the thyroid cartilage (Hamilton, Buffalo). Depression of the shoulder, elevation of the sternal end of the bone which lies in front of the trachea, and shortening of the distance between the acromion and sternum, serve to render the nature of the accident sufficiently apparent. A sling to support the elbow and forearm, with a pad and figure of 8 bandage applied so as to control if possible the head of the clavicle, is all that can be employed, after replacement has been effected by elevating the shoulder and depressing the sternal extremity by direct pressure with the fingers. *c. Backwards.*—Dislocation backwards is also extremely rare. When the result of accident, it is

always caused by direct violence applied to the part. But it may also be produced gradually, as a consequence of the change in position of parts which attends on rotation and curvature of the spinal column. When caused by accident, the head of the bone, driven according to the direction of the force, may pass directly backwards, or a little downwards, or slightly upwards. The sterno-hyoid and thyroid muscles of the affected side are torn, and the trachea is more or less compressed and displaced towards the opposite side. The obvious displacement of the head of the bone, elevation of the shoulder, impeded respiration and interference with the circulation of the head and upper extremity upon the affected side, serve sufficiently to indicate what has occurred. To effect reduction, let an assistant grasp both shoulders, and, placing his knee between, suddenly bend them backwards toward each other; while the surgeon in front pulls forward the end of the bone. For retention it is necessary to remove the shoulder from the side; and this may be done by placing a large pad in the axilla, and binding down the lower end of the humerus. In an example of pathological dislocation dependent on spinal curvature, it was found impossible to retain the end of the bone in its proper place; and the distress occasioned by its backward pressure proved so great as to lead to extirpation of the offending part.*

2. *The Acromial Extremity* is not unfrequently displaced *upwards* over the acromion process, by falls on the shoulder; the amount of deformity and inconvenience, in ordinary instances, being proportioned to the degree of laceration of the capsular ligaments. In cases of severe accident and extreme displacement, the coraco-clavicular ligaments must also suffer to some extent. The shoulder is depressed; and the end of the clavicle is seen and felt rising over the spine of the scapula, to the extent of from half an inch to an inch. Reduction is effected by repression upon the displaced part of the bone, along with elevation and retraction of the shoulder; consequently the same treatment is necessary as for fractured clavicle; but maintained with unusual accuracy, as well as for an unusual length of time—the bone being so liable to re-displacement, as hardly to be kept *in situ*, while consolidation of the ligamentous apparatus is apt to prove both tardy and imperfect.

Dislocation of the Acromial end of the clavicle downwards beneath the acromion, and also *under the coracoid process*, has been described by some authors. The former may possibly happen from direct violence, but must be an exceedingly rare accident; how the latter injury can ever occur does not seem very obvious.

Dislocation of the Latissimus Dorsi Muscle—Paralysis of the Rhomboids.

Young men who use the arms violently in their habitual occupations, occasionally suffer from this accident; and sometimes it occurs in children of a weak and relaxed habit, in whom it has been attributed to rapid circumduction of the arm, as in throwing stones, etc. The lower angle of the scapula escapes from beneath the latissimus dorsi, causing projection of the bone, particularly when the arm is elevated or abducted

* A. COOPER on Dislocations, last edition, p. 354.

from the side, with pain and loss of function in the limb. The prominent angle of the scapula is easily restored to its normal contact with the side, by direct manipulation, while the arm is much raised and brought backwards, so as to relax the muscle; and by bandaging the scapula down to the side the normal relation may be maintained. On resuming the use of the arm, re-displacement is very apt to occur; a circumstance of the less moment, however, as in time both power and extent of motion are almost completely regained, independently of reduction.

A more serious deformity is connected with *paralysis of the rhomboid muscles*, and occurs in young persons who follow constrained and sedentary avocations. Displacement of the lower angle not only takes place; but, besides, the base of the bone projects forwards, on moving the shoulder, to such an extent as almost to admit of the hand being placed between the subscapularis and the ribs. In this case, treatment must be mainly constitutional; but the attention is also directed towards restoration of tone in the faulty muscles, by galvanism, friction, and other means.

Dislocation of the Humerus at the Shoulder-Joint.

This joint is more frequently dislocated than any other. The accident is usually occasioned by indirect violence, assisted by muscular contraction, as when the patient falls upon the hand or elbow; it may, however, be directly produced by blows upon the shoulder or upper part of the arm, when the elbow is abducted from the side; and also by violent muscular contraction when the elbow is in a like position, the latissimus dorsi and pectoralis major being then, along with the weight of the patient's body, the active displacing agents. Dislocation of this joint sometimes occurs, also, during an epileptic paroxysm. The head of the humerus may be displaced from the glenoid surface in three different directions, viz., *forwards, downwards, and backwards*; the first of these including *three* degrees of displacement; the second, but *one*; the last, *two*. The symptoms of these different forms have certain points in common; and certain which are special, and therefore distinctive. To those symptoms which are common to all, we would first direct attention. The most obvious are—*1st*, The abduction of the elbow from the side, and impossibility of adducting it or depressing it so as to bring the elbow and arm in contact with the thorax; or so as to admit of the forearm being brought across the chest, and the hand laid over the opposite shoulder (Dugas). *2d*, The acromion stands out in sharp outline, and the upper deltoid region is flattened. *3d*, The axis of the humerus is altered, and the head of the bone can be felt in its abnormal position, while the glenoid cavity is vacant. *4th*, The circumference round the acromion and over the acromion is longer on the injured than on the sound side.

Sir A. Cooper's nomenclature of the different forms of dislocation, as given above, has been, in this country at least, usually assumed as sufficiently correct for purposes of description. There are, however, two very serious objections to its continued employment; *one*, that he describes the dislocation downwards as most common; and *the other*, that he makes it synonymous with the dislocation into the axilla; the real fact

being that one form of the dislocation forwards (intracoracoid) is really the most common ; while "the dislocation into the axilla" may, with more propriety, be employed to designate *all* the forms of dislocation forwards. Malgaigne's nomenclature has the further advantage of being anatomically definite ; and this, by avoiding any possibility of mistake, renders it more accurate and easy of reference than any other.

In the dislocation *forwards*, the head of the humerus has three anatomical positions. 1st, *Subcoracoid* ; 2d, *Intracoracoid* ; 3d, *Subclavicular* (Malgaigne). To the last of these forms (subclavicular) the term "forwards" was alone applied by Sir A. Cooper ; the others (subcoracoid and intracoracoid) were by him undoubtedly included with the dislocation "downwards," or "into the axilla," to which, however, as described by him, their anatomical characters have no relation. In the dislocation *downwards*, the head of the humerus has but one anatomical position—*Subglenoid* (Malgaigne). In the dislocation *backwards*, the head of the bone has two positions—*Subacromial* and *Subspinous*.

The relative frequency of these different forms is as follows :—1st, *Intracoracoid*, the common form ; 2d, *Subglenoid* ; 3d, *Subcoracoid*, rare ; 4th, *Subclavicular*, *Subacromial*, and *Subspinous*, all very rare.

While then the intracoracoid and subglenoid forms of dislocation were included under the designation of dislocation downwards into the axilla, that form of displacement was naturally considered the most common. We must now regard the intracoracoid dislocation, *forwards*, as certainly most frequent of all.

In contemplating the mechanism of these displacements, it will simplify matters very much to take the *three forms of dislocation forwards together*, and consider them simply as different degrees of the same injury. When, then, the head of the humerus becomes displaced forwards, the capsule giving way in front beneath the tendon of the subscapularis muscle, that muscle is bulged forwards into the axilla by the head of the bone, the anatomical neck of which lies in contact with the axillary margin of the glenoid surface, constituting the *subcoracoid* dislocation of Malgaigne. If the supra and infra-spinati muscles or tendons remain untorn, and the greater tuberosity intact, the abduction of the arm, with the elbow advanced and the inner condyle rotated forwards, is the position in which the arm will be placed. If, however, the arm has been forcibly adducted by the injury which has produced the dislocation, the head of the bone may occupy another position ; the lip of the glenoid surface now corresponding to a line in the axis of the neck of the humerus, lying posteriorly midway between the greater and lesser tuberosity. The dislocation is now *intracoracoid*, the rounded head of the humerus lying to the inner side of the coracoid process. To permit this dislocation to form, the supra and infra-spinati muscles, or the greater tuberosity, must have sustained a solution of continuity. Here the rotation outwards, and abduction of the arm, are less marked than in the former instance. In both of these dislocations, the elongation of the arm does not amount to more than half an inch ; the position of the head of the bone, the altered axis of the arm, the flattening of the upper deltoid region, and the squared margin of the *posterior* acromial region, being all quite pathognomonic. When the dislocation becomes *subclavicular*, the

lesion of parts is now more extensive still ; not only are the muscles inserted into the greater tuberosity torn, but either the subscapularis is detached from the lesser tuberosity, or the head of the bone penetrates that muscle, traverses the axilla, and becomes lodged between the *coracoid* process and the *clavicle*—a rare injury, constituting *the dislocation forwards beneath the pectoral muscle* of Sir A. Cooper and others. Here the flattening of the shoulder beneath the whole of the acromion is better marked, the arm is abducted, and the elbow carried somewhat backwards, the axis of the limb corresponding to the middle of the clavicle ; and while the head of the bone can easily be distinguished through the pectoral, it can only be felt from the axilla when the arm is completely abducted from the side, so as to bring it downwards towards the floor of the cavity. This is the *only* dislocation of the head of the humerus where the arm is *shortened* ; and in it, also, the empty glenoid cavity can readily be felt through the *deltoid*.

The *subglenoid dislocation*—"The dislocation downwards into the axilla," of Sir A. Cooper.—Here the head of the bone passes downwards, extensively lacerating the capsule in front of the long head of the triceps in its lower part, and rests upon the triangular surface of the axillary costa of the bone immediately beneath the glenoid surface. The supraspinatus is always torn ; also the infra-spinatus, subscapularis, and long tendon of the biceps, are often found to have given way. The circumflex nerve is either torn or put upon the stretch, while the head of the bone compresses and stretches the whole of the axillary plexus of nerves. The flattening of the whole subacromial space, abduction of the arm, elongation of the limb, the presence of the head of the bone in the floor of the axilla resting on the costa of the scapula, felt without abducting the arm, render the nature of the accident sufficiently plain. The abduction is usually considerable ; but the vacant glenoid cavity cannot be felt so distinctly as in the subclavicular form of displacement. The direct injury to the circumflex nerve, and pressure on the axillary vessels and nerves, usually render this form of dislocation more painful, and the hand more benumbed and liable to cedema than in the other ; while permanent flattening of the deltoid, from atrophy of the muscles, may result, even when the dislocation has been reduced within a short period after its occurrence.

The *subacromial* and *subspinous dislocations*. *Dislocation backwards, or on the dorsum of the scapula*.—This form of dislocation, although undoubtedly of rare occurrence, has been seen by most surgeons of large hospital experience. In most instances where it has happened, the patient has fallen upon the arm and shoulder ; or it has been occasioned by indirect violence, or by powerful muscular contraction when the arm was abducted from the side and carried forwards. The strong support given to the head of the humerus by the tendinous structures of the supra and infra-spinati muscles, tends to prevent the occurrence of this accident, and renders it more rare than the others already described. Either the anatomical neck of the bone, or the bicipital groove, may correspond to the posterior margin of the glenoid fossa ; and in the former case, the dislocation of the head of the bone is *subacromial* ; in the latter, it becomes *subspinous*. Sir A.

Cooper gives a detailed account of a dissection of an old example of this kind. In it the dislocation was subacromial, the head of the bone resting against the posterior edge of the glenoid fossa. The tendon of the subscapularis and the corresponding portion of the capsular ligament had been torn. The supra-spinatus was put on the stretch, while the infra-spinatus and teres minor were relaxed; the long head of the biceps was elongated, but not ruptured. The characteristic symptoms of this accident are projection of the head posteriorly in the subspinous fossa, the arm directed downwards and forwards, with the elbow rotated inwards, and a depression beneath and in front of the acromion, which extends deeply between the posterior margin of that process and the coracoid. Diagnosis is usually made with great facility.

In considering the methods of effecting reduction of a dislocated shoulder, prominence is given in the first place to those most appropriate to the *intracoracoid* and *subglenoid* forms.

Reduction may be effected in a variety of ways. *By circumduction*, when the dislocation is recent, more especially when the patient is still suffering from the shock of the accident. Placing him in the sitting posture, the surgeon seizes the arm just above the elbow, and as he carries the elbow outwards, backwards, upwards, and forwards, he presses upon the head of the bone with the finger or thumb of the other hand, and urges it into its socket. In many cases, whatever the direction of the displacement, the reduction will be found easily effected.

By extension at right angles to the body, or in the axis of the displacement—the axis of extension being intended to relax the deltoid, supra-spinatus, and infra-spinatus muscles, which, according to Sir A. Cooper, are the principal opponents of reduction; or rather, it admits of the head of the bone being drawn straight back through the rent in the capsule, in the direction in which it was displaced. The only objection to this method is, that the pectoralis major and latissimus dorsi are strained upon, and thus tend to keep the head of the bone in its displaced position. If it be adopted, it is well, therefore, to relax the biceps, also, by flexion of the forearm; the laque being attached, if required, above the elbow. The patient may be either seated or recumbent; and counter-extension is made by a broad sheet or belt passed round the chest—pressure being at the same time made against the margin of the acromion, so as to fix the scapula more completely. This may also be effected in the absence of assistance, by the surgeon sitting beside his patient lying in the recumbent position, and, with the ball of his great toe pressed against the under margin of the sharply-defined acromion, making steady extension outwards, while traction is effected from the patient's wrist. After extension has been duly sustained, and all adhesions broken up by rotating the head of the bone in movements of the forearm, the force is suddenly slacked, and a jerking, coaptating movement is exerted on the head of the bone upwards—the humerus being used as a lever. When the patient is seated, much power in coaptation is obtained by the surgeon placing his foot on the chair, with his knee lodged in the patient's axilla; he then seizes the forearm in one hand, while with the other he steadies the acromion process; and, as extension is gradually made, he rotates the forearm backwards and forwards,

endeavouring at the same time to raise the head of the bone by forcing up the knee, and, as the extension is relaxed, by depressing the elbow.

By extension parallel to the axis of the body.—Thus we may succeed, single-handed, in recent or otherwise favourable cases ; and, when chloroform is administered, this method will generally be found most useful. The patient is laid recumbent ; and the surgeon places himself, sitting, by his side. Taking hold of the hand or wrist of the injured limb, and, having taken off his own boot, the surgeon places his heel in the axilla, on the head of the bone ; and as he makes extension by pulling towards him, he effects counter-extension by the pressure of the heel, while at the same time he applies direct coaptative force, by carrying the arm across the chest over the fulcrum afforded by the foot. Or, instead of pulling by the wrist, a laque may be fastened above the elbow ; by a strap or towel attached to which, and passed behind the surgeon's back, extension may be made ; leaving the forearm free for rotation, if that seems requisite. Care must be taken, however, that the heel's force is neither excessive, nor unduly directed ; for it has happened that, failing to reduce a dislocated humerus, the operator has caused fracture of the ribs. Rupture of the axillary artery, also, with subsequent formation of false aneurism, has been caused by the heel—booted, and used rashly. Failing with the heel, the strap for producing counter-extension is placed in the axilla, and extension made steadily with pulleys, with such rotation and manipulation as seem necessary. In imitation of the fulcrum of the heel occupying the axilla, and leaving its border free, Mr. Skey employs a large iron knob, well padded with leather, and large enough to occupy the armpit. From this, two strong straight branches extend laterally, to which the counter-extension straps fastened to a staple are attached. A large worsted ball fastened to a stout iron bar may be employed for the same purpose.

By extension upwards (Malgaigne).—The acromion and chest are steadied, while the arm is raised above the head ; and extension is made in a direction upwards, with the further assistance of coaptative efforts directed against the head of the bone. This may be effected by means of pulleys, the counter-extension strap being placed over the acromial part of the shoulder. Should these not be at hand, the surgeon, sitting with his foot placed over the acromion, raises the arm and extends it upwards, while he pushes downwards and steadies the shoulder—the heel, if need be, being placed over the relaxed deltoid between the humerus and the acromion, so as to form a larger fulcrum for the extrication of the head of the bone from its displaced position. It is expected, however, that these latter proceedings may not be required, the bone slipping into its place during the upward movement.

In the subclavicular form of the dislocation forwards, the extending force is to be made downwards and backwards, in a line with the body ; not in a rectangular direction ; in order to avoid the resistance of the coracoid process. Reduction in cases of dislocation *backwards*, may be effected very simply, by merely elevating the arm, and carrying the hand behind the head. Failing this, the ordinary means are to be employed, as for dislocation downwards.

Reduction may take place suddenly, and with a snap ; or gradually and without noise. Then the arm is secured to the side, by bandaging, and retained so for a few days.

Such details as to reduction apply mainly to those cases, in which either anæsthesia is not employed, or where the efforts at reduction are made in a dislocation of old standing. In recent cases, with the full effect of chloroform, the muscular frame is so relaxed, that it makes but little difference in what direction the extension is made. The great practical difficulty in effecting the reduction of old standing dislocations of the shoulder as compared with the hip joint, is due to the extreme mobility of the scapula, and the consequent difficulty—nay, impossibility of effecting complete counter-extension. The split cloth, or axillary belt, with the acromial strap, is not satisfactory ; as it either permits the scapula to rotate, or so compresses the muscles around the head of the humerus as positively to oppose our efforts at extension. Hence the much greater success which has been found to attend upon coaptative efforts. The only part of the scapula which admits of being steadied is the *acromion*, and upon the fixing and steadying of it, as we have indicated, our counter-extension should be directed. It has even been suggested that a steel instrument, provided with two or three sharp hooks, should be passed through the deltoid, and fixed in the under surface of the acromion, to which the counter-extension straps, or the weight of an assistant, may be attached during the efforts at reduction. Care must be taken, if this instrument is employed, that the acromion is not torn off by the reductive force which will then act chiefly upon it.

Efforts at reduction are likely to succeed in any case under seven weeks. In some exceptional instances, reduction has been effected so late as the twelfth week ; but after two months this must be considered the exception, not the rule ; and it has been chiefly in such cases that violent and abortive efforts have terminated in fracture of the ribs, and injury to the parts contained in the axilla. When our prudent efforts at reduction fail, the result of continued passive, followed by active movement of the shoulder, is attended by the restoration of such a degree of usefulness to the arm as to permit of the patient satisfactorily following the most laborious occupation.

Subluxation forwards, or on the coracoid process, and subluxation upwards against the Acromion, are by some authors admitted as possible displacements ; by others their occurrence is denied, and the changes which have been observed in pathological specimens, and supposed to be the result of subluxation, are by them attributed to disease of the nature of chronic rheumatic arthritis of the shoulder-joint and adjoining parts. A displacement takes place in the former direction, when the greater tuberosity of the humerus is broken off, or when the supra and infra-spinati muscles are torn through ; and the dissections and inquiries of Mr. J. G. Smith and Mr. Soden seem to indicate, that a rupture of the tendon of the long head of the biceps, or a laceration of the fibrous tissues which complete the bicipital canal, permitting the tendon to escape, will be attended either by a like shift in the head of the bone, or by a *displacement upwards against the acromion*. The symptoms usually described as attending upon the first mentioned form of injury are—slight flattening

of the posterior subacromial region, while the head of the bone is felt and seen projecting forwards beyond the level of the point of the coracoid process. When the long tendon of the biceps is torn, or displaced from the bicipital groove to a position over the lesser tubercle, and the head of the humerus escapes upwards, in contact with the acromion, and projects outwards and forwards, the lesion is noted by loss of power in the biceps, by pain in the seat of injury, and by the peculiar deformity attendant on the upward displacement of the head of the bone.

Reduction is effected easily ; in fact the manipulation required for diagnosis generally succeeds in producing replacement ; the difficulty often remaining, however, in retaining the head of the bone in its natural position. A pad in the axilla, with flexion of the forearm, while the arm is carried across the chest, supported from the elbow in a sling, and bound to the side by a bandage, which includes the lower part of the arm and the chest, is all that can be done when the displacement forwards exists. If the shift is upwards and outwards, the hand should be supported, while the elbow is permitted to hang loose, so as to allow the weight of the arm to depress the head of the bone to its normal level.

Dislocation of the Head of the Humerus complicated with Fracture.—The fracture in these circumstances may involve the scapula, or the humerus, or both bones. When the *scapula* suffers, the anterior lip or lower margin of the glenoid cavity is usually the part affected. I have seen a case of this kind where the dislocation was intracoracoid ; the fracture was not detected during life, though from the impossibility of effecting retention its existence was suspected ; and after death the line of fracture was found to pass obliquely from above downwards, and from without inwards, breaking off the glenoid surface, and the portion of bone into which the long head of the biceps is inserted. The symptoms present are those of dislocation (subcoracoid or subglenoid), with possibly the presence of crepitus when the reduction is being effected, or when the parts are manipulated in examining the injured shoulder ; so soon, however, as reduction is completed, the head of the bone becomes spontaneously again displaced, and on careful examination the broken fragment may even be felt from the armpit, when the fingers are forced upwards to the axillary costa of the scapula. Treatment should consist in reduction, and careful and continued retention, by means of a pad in the axilla, and a sling and bandage confining the elbow to the side. This apparatus should be worn for several weeks ; and in most cases the result, so far as usefulness of the arm is concerned, is satisfactory, although the flattening of the deltoid region posteriorly usually remains, and perfect circumduction is not restored.

Fracture of the greater tuberosity of the humerus is attended, as we have already seen (p. 936), with modified symptoms of subcoracoid or intracoracoid dislocation. There is no flattening beneath the posterior margin of the acromion, the elbow is not rotated outwards, nor is abduction of the arm marked as in dislocation. The deltoid region is increased in transverse width. In these cases, probably, dislocation first takes place, with the posterior inter-tubercular line lying over the anterior

margin of the glenoid fossa ; and the sharp edge of this, acting like a wedge, splits up the head of the bone, and detaches the greater tuberosity, which is drawn backwards by the muscles inserted into its upper margin.

Fracture of the neck or shaft of the humerus may complicate a dislocation of the shoulder-joint. The dislocation first occurs, then the fracture. The line of fracture may be through the anatomical neck, splitting off the rounded head of the humerus, or through the surgical neck of the bone, or at some part of the shaft below the neck. The two first forms are the most common, and, in my own experience, fracture of the anatomical neck has occurred more frequently as a complication of dislocation than fracture of the surgical neck of the bone. The fracture of the anatomical neck has to most authors seemed difficult of explanation ; but if the position of this portion of the humerus upon the sharp anterior margin of the glenoid surface be the relation it occupies in the first or slighter degrees of dislocation forwards, beneath the sub-scapularis muscle, it need be no wonder that the articulating surface should be cut off, if a further force come into action, impinging the displaced head of the bone in an antero-posterior direction against the glenoid margin. In such cases the fractured head of the bone remains displaced, while the upper part of the shaft may either abide in contact with the head of the bone, or be restored to its ordinary site, in so far, at least, as its other and external relations are concerned.

The symptoms present, when the shaft of the bone returns to its position, are those of fracture of the anatomical neck ; but the displaced head of the bone can be felt from the axilla when the arm is abducted from the side.

When the upper part of the shaft remains displaced, and in contact with the head of the bone, the distortion of the dislocation is obvious ; but mobility and crepitus render the diagnosis doubtful. The displaced head of the bone, however, uninfluenced by rotation of the shaft, and the facility with which the deformity of the arm can be undone, will suffice to indicate the true nature of the injury.

Fracture through the Surgical Neck, complicating dislocation of the head of the humerus, presents all the characters of dislocation so far as the region of the deltoid and acromion is concerned ; but the deformity of the arm is that of fracture, crepitus is markedly present, and the displaced head of the bone is readily recognised.

Fracture of the shaft complicating dislocation may, except in so far as treatment is concerned, be regarded as an independent injury.

Treatment.—The great indication in these cases is to effect immediate reduction. In the last case (fracture of the shaft), by the firm application of splints to support the broken bone and restore its continuity—the patient having been put deeply under the influence of chloroform—this will be found easy of accomplishment, coaptative effort being combined with the usual extension and counter-extension. In the two former cases, when the line of fracture passes through the neck of the bone, splints are of no service, and extension and counter-extension of no avail ; all must depend upon the employment of coaptative efforts when the muscular system has been fully relaxed by the administration of chloro-

form. The older surgeons recommended delay, until the union of the fracture had become complete ; but if such delay be allowed, for even a much briefer period, our chance of effecting reduction of the displaced head of the bone is lost. In cases of fracture through the anatomical neck, the separated and displaced head of the bone communicates a very illusory sensation to the surgeon, who at first, until he attempts to seize it, might imagine that its replacement would be easily effected. It glides about, however, eluding his pressure, so that it will be found rarely, though certainly occasionally, amenable to reduction. In fracture through the surgical neck the efforts at reduction are more likely to be crowned with success, as the head of the bone can be more firmly held, and admits of greater purchase being obtained upon it. When, with a view to coaptation, reduction has not been effected in the first instance, experience teaches us, after the fracture has united, to make no efforts at remedying the dislocation ; as in one such instance, where no history of the case afforded a clue to the originally complicated nature of the injury, the reductive attempt made with the heel in the axilla refractured the bone without influencing the dislocation. It has been advised in obstinate but recent cases, where sufficient purchase is not obtained through the skin, to introduce a tooth-punch through a puncture made with a tenotomy knife in a safe and convenient situation, and by lodging its point in the cancellated texture of the bone, thus to effect replacement of the displaced head by direct leverage. This is obviously attended with considerable risk. In all cases, whether the dislocation is reduced or not, the fracture should be carefully treated by appropriate apparatus. The risk of necrosis is not great.

Dislocation of the Radius and Ulna at the Elbow.

1. *Backwards.*—Both bones of the forearm may be displaced backwards, without fracture of any part, by falls on the hand, with the elbow in a state of semiflexion, or by violence applied to the lower part of the arm, above the elbow, when the bone is fixed. The joint is much deformed, and has its motion greatly abridged. The hand and forearm are midway between pronation and supination, the joint is usually bent at an angle of 120° , and can be neither flexed nor extended completely ; sometimes, but less frequently, the arm is straight. The olecranon forms a very marked projection posteriorly, which is sensibly increased if the arm is flexed ; and, on careful examination, the olecranon is found on a considerably higher level than the external condyle of the humerus, below which it should be in the natural state of parts when the arm is slightly flexed. The coronoid process of the ulna rests in the cavity which ought to receive the olecranon ; and on each side of the latter process a hollow is caused, by the displacement backwards of the brachialis. To distinguish this injury from fracture through the condyles,

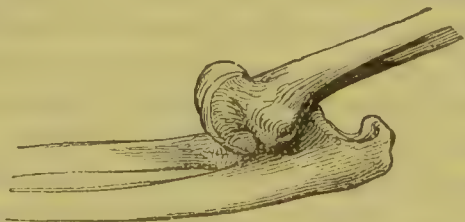


Fig. 307.

Fig. 307. Dislocation of both bones backwards.

measurement of the forearm, from the external or internal condyle of the humerus to the styloid process of the radius or ulna, shews a sensible shortening of the forearm, while the distance between the acromion and external condyle remains unaltered. The transverse fold in the skin in front of the elbow-joint further corresponds to a point *above* the projection of the trochlea of the humerus, which, projecting forwards, forms a hard swelling behind the tendon of the biceps and the brachialis anticus. The last-named muscle is usually only stretched over the end of the humerus; sometimes, however, it is torn; and the median nerve may also be extended over the projecting trochlea. Some writers speak of fracture of the coronoid process as a common accompaniment.

Reduction may be effected in two ways. *a. By extension from behind.*—This is by some considered the preferable mode. The patient is placed with his back to the surgeon; and the shoulder having been fixed, extension is made from the wrist, with the arm directed backwards at right angles to the trunk, so as to relax the triceps muscle. Very frequently, in recent cases, the operator thus succeeds, single-handed, with the left hand making counter-extension on the scapula. In difficult cases, extension is intrusted to assistants, with or without pulleys, the patient being under chloroform. *b. By forcibly bending the joint over the knee.*—The patient having been seated on a chair, the surgeon places his knee in front of the elbow. Pressing the knee down upon the upper part of the forearm, the coronoid process is separated from the humerus; and then, by forcible but gradual flexion, reduction is effected. *c. By coaptation, either singly or in combination with extension.*—This is effected by the surgeon holding the elbow embraced between his hands, the thumbs pressing back the end of the humerus, while with his fingers he urges the olecranon forwards; an assistant may extend and then gradually flex the forearm, while the surgeon is occupied with the direct manipulation of the joint.

2. *Laterally.*—Both bones may be displaced laterally, as well as backwards, in two ways; to the inside or to the outside. These injuries are usually produced by falls upon the inner or outer side of the upper part of the forearm, and are occasioned partly by the direct force of the injury, partly by the twisting of the forearm. In neither of these displacements, when simple, do the articulating surfaces pass completely clear of each other. In each, the extraordinary zig-zag line of the arm and forearm, with more or less twisting of the forearm inwards or outwards, usually suffices to indicate the nature of the accident. *a. Outwards, and outwards and backwards.*—The olecranon process rests on the back part of the external condyle; and, when the dislocation is backwards and outwards, projects more posteriorly than in the simple lateral dislocation. The radius forms a protuberance on the outer side of the elbow, where its head may be felt plainly rotating. The inner condyle projects very palpably. *b. Inwards, and backwards and inwards.*—The external condyle projects. The ulna is prominent internally and posteriorly; the olecranon resting on the inner side of the internal condyle, while the head of the radius is placed either upon the trochlea or in the posterior fossa of the humerus. *Reduction*, in either case, is to be effected as in the

more ordinary dislocation of both bones backwards, coaptation being usually found more serviceable than any great or forcible efforts at extension.

3. *Forwards*.—Some writers speak of dislocation of both bones forwards without the occurrence of any fracture. But it is difficult to conceive how such an accident could possibly occur without fracture of the *olecranon*, and great injury to the soft parts co-existing.

Dislocation of the Ulna at the Elbow.

Dislocation of the ulna *backwards*, and *backwards and inwards*, has been described by different authors. The former, or a dislocation *backwards and outwards* by rotation of the forearm inwards, when flexed at right angles upon the arm, is a conceivable accident, the external lateral and annular ligaments remaining entire; but a dislocation backwards and inwards, without any commensurate displacement or fracture of the radius, is a thing impossible. We have never seen a dislocation of the ulna backwards where there was not a fracture through the inner condyle of the humerus, and are inclined to doubt the existence of simple dislocations of the ulna altogether.

Dislocation of the Radius at the Elbow.

The radius may be displaced, singly, in two directions—*forwards* or *backwards*. The former accident occurs more frequently than the latter. There seems good reason to doubt, however, if these dislocations are ever uncomplicated; fracture of the upper part of the shaft of the ulna in the one case, and fracture of the inner condyle of the humerus in the other, being the usual complication. They are always the result of direct violence sustained on the elbow, or of falls on the hand, or of twisting of the forearm. 1. *Forwards*.—The head of the bone rests in the hollow above the external condyle, and may be felt there. The forearm is slightly bent, and usually can be neither flexed nor extended completely. On attempting flexion, the head of the radius, which lies over the coronoid process, is felt to strike against the humerus, abruptly arresting the movement. When flexion continues free, the head of the radius will be found to glide outwards and upwards over the outer condyle. The hand is completely pronated, and the upper part of the forearm, instead of being flattened from side to side, is rounded. *Reduction* is effected by making direct pressure over the head of the bone, extending at the same time from the hand so as to act on the radius alone, and then flexing the forearm upon the arm in a direction as far outwards as possible.



Fig. 308.

2. *Backwards*.—The head of the radius is displaced either behind the external condyle, or, at the same time, to its outer side; and in this

Fig. 308. Dislocation of the radius forwards.

locality it can be both seen and felt very plainly, especially on extending the limb, while a depression exists corresponding to its original and normal position. *Reduction* is managed as in the preceding accident; with the hand either pronated or supinated, as may seem best.

Dislocation of the Wrist.

1. *Dislocation of the Carpus upon the Forearm.*—These bones may possibly be displaced either on the dorsal or on the palmar aspect of the forearm. The accident must, however, be a very rare one indeed; and when it does occur, will in all probability be complicated with a fracture of the styloid process of the radius. In most instances, where it has been supposed to exist, the injury has really been a fracture of the radius in its lower third, or of the radius and ulna close above the wrist-joint. Falling on the palm can alone produce displacement of the bones backwards, while a fall on the back of the hand can alone cause the opposite change. In either case, the signs would be plain; a dorsal and a palmar swelling existing, composed either of the carpal bones or of the ends of the radius and ulna, as the case might be; and, by carefully recognising the situation of the styloid processes with reference to the deformity, the nature of the displacement would be recognized, while, by farther manipulation, it would be ascertained that neither the radius nor ulna were broken. *Reduction* would be readily effected, by extension, and coaptation by pressure on the dislocated bones. And it would be well also to maintain retention for some time, by splints, as for fracture of the lower third of the radius and ulna.

2. *Dislocation of the Ulna.*—Dislocation of the ulna *backwards or forwards*, the end of the bone projecting plainly, with twisting of the hand, and the line of the styloid process shewing obvious alteration, may undoubtedly occur as a symptom of fracture of the lower third of the radius, but has been spoken of as a separate phenomenon observed by one or two individuals. Where no fracture existed, I should much doubt the accuracy of any such observations; and, in the circumstances, would recommend the treatment for fracture of the radius in its lower third to be rigidly adhered to; reduction and retention being managed as in the preceding accident.

3. *Dislocation of the Carpal Bones.*—Complete luxation of any of the carpal bones, separately, must be a very rare accident, if indeed it ever occurs without fracture or laceration of the soft parts. But subluxation of the os magnum, of the cuneiform, pisiform, and semilunar bones, is spoken of by writers on surgery. Were such displacement to occur, it must weaken the carpal joints, and in the case of the os magnum and cuneiform cause projection on the back of the wrist, during flexion. The treatment of such cases should consist in continued pressure and support by a bandage, with disuse of the hand and wrist for some considerable time, till the parts have consolidated.

4. *Dislocation of the Metacarpal Bones from their Carpal Articulation* has never occurred in our experience without fracture; which may, however, be so oblique, with the crepitus so obscure, as to be overlooked unless attentively sought for.

Dislocation of the Fingers.

By falls sustained on the tips of the fingers, dislocation of the phalanges is sometimes produced; and the displacement is usually on the dorsal aspect. It is more common between the metacarpal bone and first phalanx, and between the first and second phalanges, than between the second and third. The nature of the injury is exceedingly plain; and replacement is effected by extension and coaptation. To render extension effective, it may be necessary to affix a laque—a piece of tape, or the end of a silk handkerchief, or a riband—to the distal phalanx, by means of the glove-hitch; and in combination with such extension force, pressure upon the projecting extremity of the displaced phalanx, so as to urge it back into its normal position, will always be found essential; indeed, in many instances it will be found of itself sufficient. Sometimes the handle of a key may be used advantageously as an instrument of reduction. Lewis' hooked splint, Charriere's digit-forceps, or the Indian "puzzle," are well adapted to afford still more efficient purchase and extension power upon the end of the finger, should this be desired. The Indian puzzle consists of an elongated hollow cone, of about 16 or 18 inches in length, made of plaited ash-splittings, each continuous from end to end. The open extremity is about 3-4ths of an inch in diameter, and may easily be drawn over the part like the finger of a glove, by two ears in which its mouth terminates. When applied, and traction made from the braided cord at the opposite end, it takes so firm a grasp of the whole surface, that the finger could more easily be torn off than it would slip its hold. When we wish to remove it, we abandon traction from the end, and the two ears have only to be retracted, when it comes off as easily as it slipped on. The use of splints, for some days, is expedient in the after-treatment of these dislocations.

Compound dislocations of the phalanges do not in themselves require amputation. When, however, the soft parts are at the same time much lacerated, and the tendinous textures exposed—still more, if torn—the finger which could be retained by attempts to save, would be inconveniently in the way rather than of any service to the patient.

Dislocation of the Thumb.

The first phalanx is not unfrequently dislocated backwards on the dorsum of the metacarpal bone, and is reduced in general with difficulty, on account of the lateral ligaments, and heads of insertion of the short flexor with the sesamoid bones, which, embracing the neck of the metacarpal bone, "like a button in its button hole," oppose its retrograde movement. Extension having been steadily maintained for some time, by any of the means already described for reducing dislocation of the fingers, flexion is made towards the palm; and during this forced movement, slowly yet determinedly performed, with pressure upon the displaced phalanx from behind, reduction is usually accomplished. Should this not succeed, the thumb should be bent forcibly backwards (Roser), so as to tilt its articulating surface up to its proper level, where it should be secured by pressure with the finger or thumb of the other

hand, flexion of the finger towards the palm being then made, to complete the replacement. It may be necessary, in extreme cases, to have recourse to subcutaneous section of one or other lateral ligament, or of one or both heads of the flexor muscles; and simple central longitudinal division of the fibrous tissues, which bind the two heads and the sesamoid bones together, has also been found amply sufficient to enable reduction to be effected. With the use of chloroform, however, the necessity of such operative interference is less likely to be required.

CHAPTER LI.

INJURIES AND DISEASES OF THE SPINE.

Concussion of the Spinal Cord.

THE spinal cord, like the brain, may sustain a concussion from falls or blows ; having its functions arrested or disordered, with or without actual lesion done to its structure. The concussion may be either general or partial. In the latter case, it is probable that the whole cord suffers, though unequally ; the major effect being at and beneath the part struck—as denoted by paralysis, more or less complete, of motion and sensibility in the part supplied by nerves which take origin below the seat of injury. This paralysis is transient, but recovery is not so rapid as in the case of the brain ; the state of inaction usually, however, passing off in the course of hours, or, more commonly, in the course of a day or two ; not of longer duration when simple—that is, when not occasioned by laceration of the cord, or accompanied or followed by extravasation or effusion. As in the case of the brain, reaction may prove excessive, and inflammatory mischief may speedily supervene ; attacking the cord, its membranes, or both, and ushering in a completely new train of symptoms. Or—also as in the case of the brain—the immediate results of the injury may all seem happily to pass away ; and, at a remote period, an insidious chronic inflammatory process may occur, in the cord or in its membranes ; causing, in the one case, softening of slow progress, in the other thickening with effusion.

Treatment is guided by the same principles as in concussion of the brain. Absolute quietude is maintained ; and the catheter is introduced from time to time, should retention or dribbling be present. The period of reaction is carefully watched. If it threaten to prove excessive, as indicated by the state of the pulse, flushing of the face, and uneasy sensations in the injured part shooting downwards through the paralyzed limbs, anti-phlogistic measures are adopted, such as bleeding, leeching, purgation by medicine given by the mouth, and the use of purgative enemata, according as circumstances may seem to demand, while warm fomentation will usually afford more relief to local pain than any other application. For a long period after the receipt of injury, whether followed or not by acute symptoms, recovery is usually very slow, and may be imperfect. The patient must therefore be content, in every case, to use all the precautions of a prudent invalid, so as to avert if possible the insidious and formidable remote results. These, having threatened, are best met by rest, and counter-irritation by blistering, or the use of stimulating liniments, while appropriate constitutional treatment, consisting in the administration of mercurials and iodide of potassium, will frequently

prove of great service. At a later period, when the restoration of function has advanced partially, and then become arrested, Corrigan's cautery, warm-bathing, friction of the limbs, exercise of the muscles, encouraged by exercise and perhaps by galvanism or electricity, peripheral stimulation of the sensory nerves by painting the limbs from time to time in stripes with a strong solution of iodine or of nitrate of silver—and the use of strychnine, phosphoric acid, or ergot of rye, internally—will be found useful in the atonic state of the parts affected; while the actual cautery and atropine will be found of more service, where painful sensations exist in the injured part and in the extremities.

Compression of the Spinal Cord.—This may be caused by extravasation of blood within the spinal canal, on the surface or in the substance of the cord; by fracture and displacement of the vertebræ, producing direct pressure on the cord, with or without laceration of its substance; by inflammatory results formed exterior to the cord; or by inflammatory disorganization of the cord itself. Very obviously, any operative interference with the spinal canal by means of the trephine or otherwise, is out of the question. The progress of the symptoms, and treatment of this condition, are as already described. The circumstances in which the symptoms occur, their severity, persistence, and termination—or in the case of copious extravasation, their gradual extension and ascending involvement of the functions of those parts connected with the upper part of the spinal cord—can alone enable us, in the living patient, to distinguish between concussion and compression of the cord. In the case of extravasated blood, if the immediate risk be overpassed, we may reasonably entertain expectation of a fortunate result. On the other hand, few cases of displaced fracture are wholly recovered from. And the end of inflammatory disorganization, whether chronic or acute, is almost invariably disastrous.

Softening of the spinal cord, chronic, insidious, and intractable, is no unfrequent consequence of severe falls, or blows, upon the spine; but may occur independently of injury in those of the upper ranks of life, who have lived hard and indulged much in venereal excesses. The lower limbs first begin to fail, the extensor muscles proving unequal to maintain the erect posture, and the knees consequently ever and anon threatening to give way. The feet are moved oddly, and are not planted on the ground firmly, or with certainty on the spot intended; the legs are thrown outwards in stepping, and bring down the extended feet with a slap. The body is stooped in walking; and the line of progress is seldom a straight one. The bowels get sluggish, and the abdomen tumid from distension of the intestines with wind. The urine is voided with difficulty. The arms are found to be weak; and the fingers seem to be gradually freeing themselves from control of the will; there being the same uncertainty and inefficiency in doing anything with the hands and fingers, as was first observed in the lower extremities. Not unfrequently the patient is much harassed by neuralgic pains of a darting or plunging character, shooting down the back and limbs, and sometimes affecting the head also. Gradually such symptoms increase; urine and fæces come to be passed involuntarily, or almost so; the use of the limbs becomes more and more feeble and uncertain; the brain at last is involved; the mind

grows imbecile, as well as the body ; and the patient dies, often with symptoms of slow compression. The spinal cord, in such circumstances, may be found more or less affected with *ramollissement* ; sometimes, however, it presents no organic lesion. But little benefit can be expected from treatment. Of heroic remedies there is no tolerance. Indeed, the prudent practitioner contents himself with enjoining great temperance in all things ; while by the employment of ordinary and simple means he seeks to palliate symptoms, and delay the fatal issue. In some cases the progress of the disease undergoes a temporary, in others and more rarely, a permanent arrest.

Fracture of the Spine.

Severe and direct violence is more likely to cause fracture than dislocation of the vertebræ ; these bones being so intimately connected to each other by their bodies and articulating processes. *The spinous processes* alone may be broken. There is then little, or more commonly no, displacement ; the fracture is recognised by the mobility of the broken process ; and the consequences of the injury, so far as the fracture is concerned, are unimportant. The occurrence of slight displacement in those cases, with the presence of symptoms of either concussion or compression of the cord, may excite some anxiety on the part of the surgeon as to whether more serious fracture of the vertebræ with displacement has not taken place ; and there is no way by which this can positively be determined, till time be afforded for the spontaneous disappearance of the paralysis, which will happen if due merely to concussion, or extravasation of blood external to the membranes. But fracture traversing the posterior arch of the bone, effecting a complete solution of continuity in both posterior laminae, is liable to be attended by displacement forwards of the separated fragments upon the cord, and may give rise to more or less serious and persistent symptoms of compression or concussion. This accident is liable to be mistaken for the less formidable one of fracture of the spinous process, as well as for the more serious one of fracture of the body of the vertebræ. The mode in which the accident has occurred—fracture of the posterior arch being most likely to be occasioned by blows upon the corresponding spinous process—will serve to assist us in arriving at a conclusion in such cases of difficulty. If there is no displacement, the treatment consists merely of repose, with the employment of those measures already mentioned for the condition of concussion or compression of the cord, should such symptoms be present. If symptoms of compression exist, and are persistent, and apparently occasioned by displacement of the fractured bone, it has been suggested that operative interference should be resorted to, in order to elevate the depressed portion. This suggestion, apparently originating with Paulus Ægineta, was very reasonably and successfully adopted in 1762 by Louis, in a case of gunshot wound implicating the arch of one of the vertebræ, the patient surviving, with partial paralysis. The younger Cline (1814), Tyrrell, and others have resorted to this procedure, cutting down upon the arch of the vertebra, sawing it through on each side, and removing it along with the spinous process. In the case of fracture of the bodies of the vertebræ—as when Cline operated—the proceeding

seems absurd and unattended with any advantage ; but it has been suggested that although useless when the bodies are displaced, this operation might reasonably be adopted when the arch only is depressed and compresses the cord. Experience has shewn, however, that it is not attended by success ; and we are led to the conclusion that for the future it is unjustifiable even on the ground of affording a possible chance of recovery. The injury to the cord is really beyond remedy ; and laying open the spinal canal is only likely to set up further inflammatory mischief in the membranes.

Fracture of the transverse processes has only occurred in cases of gunshot injury ; in itself it is unimportant, except that it implies in all probability serious or fatal injury inflicted on other parts. In the neck, lesion of the vertebral artery in its canal is a likely and probably fatal complication.

Fracture of the Bodies of the Vertebrae generally results from forced flexion of the vertebral column ; when occasioned by direct violence, it is usually complicated with a fracture of the arches of the affected bone, otherwise the articulating processes either give way or become displaced. Such a complete solution of continuity in the spinal column at the injured part is always fraught with the utmost danger, not only to the function of the parts beyond but also to life ; for although Sir A. Cooper's statement that this injury, when attended with displacement, is always fatal sooner or later, is rather too absolute, the instances where recovery has taken place are certainly the exception. In all those cases where the solution of continuity in the spinal column is complete, structural injury, amounting to division of the cord within its membranes, has probably been inflicted at the same time ; extravasation of blood, too, has taken place in quantity into the canal ; and probably there is displacement of the fragments—thus adding permanent pressure by the bone to the injury originally inflicted on the soft parts within. Ordinarily, therefore, the most prominent sign of spinal fracture—besides pain, swelling, ecchymosis, and symptoms of well marked concussion or compression of those parts beyond the seat of injury—consists in angular distortion of the spine, or an irregularity in the line of the spinous processes. Sometimes mobility and crepitus are also recognisable to a very painful degree ; but all examination likely to elicit such symptoms should be carefully avoided.

According to the seat of injury the extent of the body paralysed will vary, and hence the nature of the case, so far as symptoms and prognosis are concerned, is materially different. When the fracture exists below the second *lumbar* vertebrae, the more prominent symptoms are—more or less complete paralysis of the lower limbs, usually with loss of sensation ; involuntary discharge of fæces ; retention of urine ; and, when the upper lumbar or lower dorsal vertebrae are affected, priapism is usually present. When the injury has occurred in the *upper dorsal*, or *lower cervical* region, in addition to these symptoms there are—paralysis of one or both arms, difficulty of breathing and inability to cough or expectorate, from paralysis of the thoracic parietes, sluggishness of the bowels, with tympanitic distension of the abdomen. This tympanitic distension, although unimportant in itself, becomes a great source of aggravation in

these cases, as it interferes with the descent of the diaphragm by which alone the patient breathes, and thus impedes still further, and sometimes fatally, his respiratory efforts. If, again, the fracture be *above the origin of the phrenic nerve*—and compression there prove great—respiration will at once cease, causing death. There are three principal sites in which fracture of the spine most commonly occurs, from forces producing great bending forwards of the spine. In the neck between the third and seventh vertebræ, in the back generally low down between the eleventh dorsal and second lumbar, in the loins between the fourth lumbar and the sacrum (Malgaigne). Fracture may, however, occur anywhere from direct violence.

An almost invariable result of spinal fracture, wherever situated, is a deteriorated condition of the urinary secretion, in consequence of which the lining membrane of the bladder, becoming the seat of chronic irritation, secretes an altered and increased mucus; copious, foetid, turbid, ammoniacal urine passes away, with sad aggravation of the general disorder of system. The bowels, too, are not merely distended and sluggish, but become depraved in the function of their mucous membrane; the dejections evincing a very vitiated character. Bed-sores are apt to form.

The symptoms, continuing and gravescent, frequently terminate in death; or, gradually mitigating, recovery more or less complete ensues. Obviously, the dangers to life are both many and formidable; inflammatory disease in the cord or membranes—attended with sero-fibrinous or purulent product, producing disorganization; secondary affections of the respiratory, digestive, and urinary organs; bed-sores, and general exhaustion. It need not, therefore, excite surprise to find the general average of recoveries from fracture of the spine extremely small. When we consider these injuries as occurring in the three regions—cervical, dorsal, and lumbar—we may say that recoveries from fractures rarely or never occur in the first, only occasionally in the second, while in the third, when the first few weeks are overpast without the development of serious mischief, the patient may live for years. The fatal result in the upper part of the spine is usually due to asphyxia, rapidly or more gradually induced; in the lower, from inflammatory implication of the cord and its membranes, secondary visceral disorder, or general systemic irritation.

Spinal fissure may occur, without displacement; and yet may prove fatal, from another cause than injury to the cord. Into the cleft, a portion of the membranes may be received and retained; the constriction acts as an uninterrupted exciting cause of inflammatory disease, and fatal inflammatory product or structural change ensue. The case is obscure in its course; and is likely to be unfortunate in its issue.

Treatment of spinal fracture may be reduced to simple indications; the first of which is, very careful movement of the patient, and adjustment on a hard mattress, lest further shifting of the fragments occur. Any reduction of the displacement which is found to exist, or attempts at retention by adaptation of splints, is perfectly useless, as the manipulations which would be required to effect their fulfilment are more than likely to inflict a fatal injury on the patient. We confine ourselves to enforcement of absolute quietude, antiphlogistic regimen, and the other

obvious prophylactic measures ; with moderate antiphlogistics, should inflammatory symptoms exhibit themselves. The congestion of the face, however, which exists from imperfect respiration, in the case of fracture situated in the cervical, or high in the dorsal region, must be distinguished from the flushing of excessive reaction, else blood-letting may be had recourse to under circumstances when the patient had much better be left alone. Mitigation of the unpleasant results occurring in the digestive and urinary organs must be carefully attended to ; obtaining regular and better movements of the bowels ; relieving the bladder by the catheter, at stated and frequent intervals ; and rectifying the state of the urine, by mineral acids and other medicinal means in ordinary use for that purpose. Ultimately—immediate danger having passed by—attention should be directed to amendment of circulation in the paralytic parts ; thus preventing shrinking by atrophy, and perhaps assisting in the recovery of function. The means usually employed to fulfil the last indication are, friction, shampooing, galvanism and electricity, and the use of strychnia. Galvanism and electricity are to be used with caution, however ; it being sometimes found that, although by means of these agents, muscular contractility may for a time be roused, yet the amendment is in general but temporary, and the parts ultimately lapse into even a worse degree of impotency. Counter-irritation is sometimes of service.

In the obviously displaced spinal fracture, with symptoms of compression of the cord, it has been proposed to employ the trephine, with the view of relieving the injured medullary matter. Reason and experience, however, as already indicated, have decided against the procedure, even in the more hopeful condition of fracture through the laminae. It must, in the case of fracture of the bodies of the vertebrae, where the compressing agent is usually the posterior part of the body of the bone—which, of course, cannot be reached and dealt with from behind—be worse than useless.

Dislocation of the Spine.

Dislocation of the spine, without fracture of the body or articulating processes, is a rare injury ; yet occurs, occasionally, in the cervical region ; possibly in the dorsal ;* certainly never, although cases have been supposed, in the lumbar region. It has happened by muscular power alone ; a maniac, for example, having so caused death by, as it were, forcibly throwing his head from him, during restraint in a paroxysm of excitement. More frequently it is the result of violence applied from without ; as by falls on the head or back of the neck when the head is bent backwards ; sometimes, but rarely, it is produced by direct violence. Suspension sometimes causes it, but much more seldom than has been generally supposed ; for usually there is no displacement of the vertebrae, even in criminal cases—death taking place from other causes.

The displacement may be *forwards* or *backwards*. That forwards may involve one or both of the articulating processes. When both of these are displaced, the injury is said to be *bilateral* ; when one only, *unilateral* ; and of these the bilateral dislocation forwards is most common.

* Melchiori, Gaz. Medica Stati Sardi, 1850.

The situation of the dislocation is usually between the fourth and fifth, or fifth and sixth vertebræ ; but separation may take place between any of the cervical articulations.

The displacement is easily recognisable on manipulation of the lines of the spinous processes ; and in the upper cervical region the displacement of the transverse processes may serve to assist in the diagnosis ; but the comparatively great degree of immobility in dislocation, and the existence of characteristic crepitus in fracture, though spoken of by some writers, are signs not to be sought for. The usual result to be anticipated in cases where the injury is below the third cervical vertebra, and the distortion well marked, is death of the patient within forty-eight hours—usually from interruption of the respiration. In all cases the concomitant symptoms of compressed or torn spinal cord, as in fracture, are sufficiently explicit. When life, or the hope of life remains—replacement by careful extension and coaptation has been resorted to, and been followed by most marvellous results—if at least we are to credit the very wonderful histories

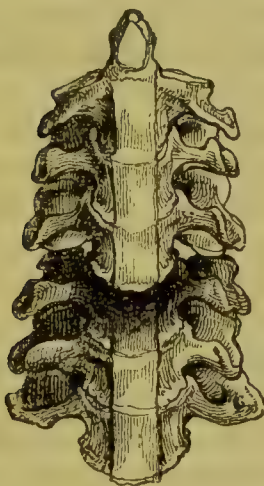


Fig. 309.



Fig. 310.

of several such cases, narrated by different surgeons. We are inclined to doubt, however, that these cases were of the serious nature supposed, and to assent to the dictum of Dupuytren that such attempts at replacement are more likely to do further injury than to benefit the patient, in a real case of dislocation of the vertebræ. Usually, therefore, the patient is to be treated as if he had suffered from concussion or compression.

Subluxation, or partial displacement, of the vertebræ is by no means uncommon ; and may take place at any part of the spinal column. It is probably of most frequent occurrence in the dorsal region ; caused by falling on the breech, from a considerable height, with consequent forcible bending of the trunk forwards. The posterior ligamentous apparatus gives way, to a greater or less extent, and a hiatus between the spinous processes results. The symptoms, in addition to the marks of displace-

Fig. 309. Dislocation of the spine ; between the fourth and fifth cervical vertebræ. The patient fell backwards over a high paling, and alighted on his head. Cord torn. Complete paralysis. Issue fatal, within a few days.

Fig. 310. The same ; seen laterally.

ment, are those of severe spinal concussion or compression ; and the subsequent dangers are also those that may be expected to follow such injury. By repose upon a firm mattress in the recumbent posture, perfect rest of the injured part is secured, with so much adjustment as this position, aided by pillows, may serve to secure. The treatment otherwise depends upon the severity, persistence, and modification of the symptoms of concussion which are present.

Lateral Curvature of the Spine.

Lateral curvature of the spine is usually contrasted with *antero-posterior* or *acute angular* curvature ; the latter the result of inflammatory destruction of the bodies of one, two, or three of the vertebræ ; the former affecting several or all the vertebræ, and originally unconnected with inflammatory structural change. In the one form of disease there is mere change of form ; in the other, there is inflammatory change and disintegration of bone, with or without the occurrence of curvature. It is right to remember, however, that in some cases the antero-posterior curve, when involving several vertebræ, is really of the same nature as the lateral distortion, and originally unconnected with inflammatory disease.

Lateral curvature may arise from different causes. And it is important to classify the cases accordingly ; that the suitable treatment may be afforded to each. *Peculiar avocations* are not unfrequently the cause. Those, for example, which entail a habitual use of the right arm, much disproportioned to that of the left ; as in blacksmiths and dragoons. The muscles of the right side become largely developed, and powerful ; and the trapezius and rhomboids, thus changed, acting on the spinal column so as to overpower their fellows of the opposite side, have the effect of gradually inducing distortion—it may be to a considerable extent. In nursery-maids, who carry children on one arm, a similar change is induced by the undue weight given to the one shoulder. Of course, this form of curvature is most likely to occur during adolescence. The remedy is simple ; discontinuance of the excessive use of the affected side, with increased employment of the other. The displacement, if recent and slight, can thus be perfectly removed.

Deformity in one of the lower extremities, by which it is rendered shorter than its fellow, as in morbus coxarius or ill-united fracture—unless atoned for by suitable mechanical contrivance—will certainly cause more or less compensating curvature of the vertebral column ; also a rigid and contracted state of the sterno-mastoid muscle of one side, producing the condition called *Torticollis*, is very apt to cause spinal curvature, as has already been noticed. In the latter case, the remedy is simple, if soon enough adopted ; by division of the offending muscle. Such a condition must, however, be carefully distinguished from curvature of the cervical vertebræ, the result of rheumatic or other inflammatory disease affecting the bodies of the bones, chiefly on one side, and thus producing a contraction of the sterno-mastoid commensurate and secondary to the spinal change.

Deformity of one side of the thorax, resulting from injury or

disease, usually produces considerable curvature of the spinal column in the dorsal region, with complimentary curves in the cervical and lumbar vertebræ; this, of course, admits of no treatment.

Bad habits of standing, sitting, or reclining, in an awkward position, are very apt to cause a greater or less amount of lateral distortion in the young. The spinal column is habitually thrown off its normal line of erection; and, in course of time, both muscles and bones, growing accustomed to their abnormal position, may become confirmed in it. And thus great curvature may be established, without any actual vice in the skeleton, in the muscles, or in the general system. Obviously, there is one class of human beings much more than any other exposed to this form of disease; namely young girls occupied in the crowded details of an imprudently managed course of education. Young people of both sexes are also very liable to suffer, who are employed in sedentary occupations in trade; as in sewing, knitting, engraving, colouring, etc. The indications of treatment are plain; discontinuance of the hurtful habit or occupation; ample amount of exercise out of doors; and a voluntary use of such gymnastic or other exercises as are calculated to produce a healthful play of the general muscular system, and more especially of the muscles of the trunk and spine.* And by means of light articles of dress, fashioned and worn so as to attract the patient's notice to the threatened deformity, while at the same time they warn of the negligence or awkwardness which has led to it, disuse of the habits in question may be greatly favoured. By some, exercise of the trunk produced by the effort to elevate, by the hand on the opposite side to the curvature, a heavy weight attached to a cord running horizontally over a pulley, has been found to act correctively on the curve.† All cumbrous apparatus—in the shape of stays, or other machinery—are plainly to be avoided, as certain to prove hurtful.

Hitherto we have spoken of simple deformity of the spine, due to no disease in it, but simply constituting a natural effort to correct or atone for certain conditions of deformity situated elsewhere. Now we have to do with disease. This form of distortion, occurring as it uniformly does, in young persons of the female sex, between the ages of seven and twenty years, is undoubtedly due to two causes—one, a softened condition of the bones constituting the vertebral column; the other, debility of the muscles which support, move, and control the trunk and spine. Without a softened condition of the bones, we have undoubtedly seen that curvature may occur; but such distortion is slight comparatively, and never greater than to be commensurate to the cause which calls it into action. In the disease we are now considering, these exciting causes also exist, and are apparently much of the same kind as those we have already described; but they produce a more decided influence both as regards continuance and degree of effect, simply because the osseous tissue of the spinal column is softened by certain predisposing circumstances, which must be taken into account in considering the treatment of this affection. Of these, *unduly rapid growth—a flabby, soft relaxed, habit—and general debility*, however induced, are frequent causes of lateral

* Sir B. BRODIE, *Lancet*, No. 1218, p. 3, *et seq.*

† Dr. BROWN of Boston, *U. S. Lancet*, No. 1329, p. 178.

curvature ; and of such debility, insufficient food and clothing, excess of confinement and work, febrile or other affections leaving the system exhausted—are common excitants, to which all ranks of life are subject. The muscular system of the back grows especially weak when cramped in fashionable articles of female dress, which, by affording an uncalled-for support, permit the natural means provided for the erection and movement of the spine to become atrophied. The muscles, consequently, grow unequal to their proper task, and deviation from the straight line results—at first occasional, afterwards habitual, ultimately confirmed and progressive ; for now the weight of super-incumbent head and shoulders is afforded a greater leverage, and tends more powerfully to compress the softened bone on the side corresponding to the hollow of the curve. At its commencement the change is slight, and its progress insidious ; and the beginning of curvation is most likely to take place in the lumbar region—at the basis of the pyramid of support ; but the complimentary or counter-balancing curvature in the dorsal region is usually better marked, and first attracts attention—projecting, as it usually does, to the right side, and producing elevation of the corresponding shoulder, with prominence of the scapula. Not unfrequently, there is a third curve ultimately established in the cervical vertebræ, in a direction opposed to that of the dorsal. As the amount of bending increases, rotation of the bodies of the vertebræ on each other generally takes place—the rotation being towards the same side as the curve ; the height of the spinal column, too, greatly decreases, the thorax becoming shortened and laterally compressed ; and, in consequence, serious changes happen to the thoracic and abdominal viscera. The ribs expand on one side, while they are approximated and imbricated on the other ; and they fall inwards, narrowing the chest in its lateral direction, and producing prominence of the sternum and of the costal cartilages. The heart and lungs become incommoded, and labour in their function. The sternum, too—with its costal appendages—has approached unusually near to the pelvis ; the abdominal space is narrowed in consequence, and its organs are injuriously affected.

At first, the spinal change is chiefly in the inter-vertebral spaces ; and the deformity, at that time, is capable of being undone, by appliances from without, or, partially at least, even by the efforts of the patient. But ultimately the bones become consolidated in their new relation ; permanent thinning of the body of the vertebra remaining on the compressed side, while corresponding expansion exists at that which is free. Then the deformity has become fixed and irremediable—a circumstance of very important and obvious bearing on the question of treatment. The great and distinguishing characteristic of this form of disease is the absence of all general affection of the osseous system, the pelvis and limbs remaining quite free from participation in it.

The indications of treatment are directed fully more to the state of the general system than to that of the part affected. In the early stage, when only commencing, a tonic regimen is to be sedulously attended to. All corsets or confining apparatus, continuously worn, must prove prejudicial ; the muscles, already weak, will be enfeebled more and more ; and the original malady cannot fail to sustain aggravation. Good diet

and clothing ; regulation of the bowels ; exposure to good air ; cold bathing ; judicious use of medicinal tonics ; friction of the back, acting more especially on those muscles which seem most deficient ; healthful exercise, both of the general body and of the muscles of the trunk—short of fatigue ; and rest in the recumbent posture upon a firm sofa when in-doors, reading or working—will suffice not only to prevent further progress of the disease, but to restore symmetry in most cases. When the curvature has already formed, all active exercise must be abandoned, and the patient must maintain the recumbent or prone position constantly, lying upon a firm mattress or sofa, without pillows to prop and support the back and head. In the course of time the curvature will materially diminish. When this happens, the treatment already recommended for slight and commencing cases should be gradually adopted ; the exercise being frequently taken, but only for so brief a period as shall secure the patient from being fatigued, and the muscles of the spine from being wearied. To produce further improvement, and to enable milliners, dressmakers, governesses, and others in whom the disease is not far advanced, and whose circumstances do not admit of the complete repose from work which such treatment demands, to continue at their avocations uninterruptedly—various ingenious mechanical contrivances have been employed, and have received the sanction of men of note in the profession. The best of these consists of a light, well-padded metal girdle, resting on, and fixed round, the loins and pelvis ; from which a crutch is elevated to support the depressed shoulder, as also a metal bar moving as the radius of a circle ; this bar is jointed centrally behind, and controls and tightens a broad elastic belt, firmly fixed in front, which is passed under the arm and round the projecting side of the thorax. Both good judgment and daily attention are required in the use of such an apparatus, if real good is to be secured from its employment. Myotomy has been practised, both in this and in other forms of spinal distortion ; but with no good result. The experience of the profession is opposed to it.

Rickets is certainly not the least common predisposing cause to spinal distortion. And the curvatures so occasioned are at once the most rapid and decided in their progress, and the least amenable to treatment. The peculiar characteristic is indication of the rickety state, in the general appearance, and in the existence of distortion in other parts of the skeleton, as well as in the spinal column. The results of extreme spinal curvature, usually with rotation, are rapidly developed ; and, at the same time, the pelvis and lower limbs, as well as the clavicles and the superior extremities, are somewhat distorted. Usually, the direction of the spinal curvature is lateral ; but it may be antero-posterior. The treatment—prophylactic and curative—is conducted on the ordinary therapeutic principles. Here mechanical aids, in the shape of stays and belts, are to be used warily, if at all, as the pressure of such an apparatus as that already described, certainly the least objectionable of any, is liable, if effectual in diminishing the curvature of the spine, to inflict commensurate injury upon the form of the pelvis, which, in the case of the female—in whom the rickety curvature of the spine is most common—would be to induce, or at least to increase, a more serious, if less obvious, deformity than that from which the patient ostensibly suffers.

Rheumatic arthritis and otitis frequently affect the vertebræ of the dorsal and cervical regions ; producing gradually such change, by curvature from softening of the bones, and ankylosis from ossification of the intervertebral cartilages—with stalactitic osseous deposits external to the bone—as to render the spine both greatly deformed and rigid. The curvature is a combination of the antero-posterior and lateral distortions. The affection occurs chiefly in the adult and aged, and is the source of the gradual bowing and shortening of the trunk observed in senility, and usually regarded as a natural change. The disease is, generally, in well-marked cases, preceded by other indications of a gouty or rheumatic diathesis ; and it seldom or never progresses continuously, but has well-marked intermissions—distortion being very gradually attained. It requires the treatment of the rheumatic diathesis, with the employment of measures calculated to relieve pain, and check the local inflammatory progress to which the change is due.

Disease of the Bodies of the Vertebræ.

Interstitial softening by absorption of the calcareous elements of the osseous texture, and the substitution of *medullary tissue* in its stead, frequently occurs in the vertebræ, in connection with curvature of different kinds, as already stated ; whereby a distortion, at first remediable, becomes ultimately, when ossification is complete, confirmed and unalterable. It also occurs of an inflammatory type, as a primary affection, in the bodies of the vertebræ ; usually as a prelude to a rapid transformation into *granulation tissue*, which results in suppuration and carious ulceration. More rarely, in young persons, it exists as a separate and distinct disease ; implicating several vertebræ, and causing displacement by curvation forwards at the affected part. Here, again, complete ossification, following after a time, confirms the curve by consolidation. Treatment is by absolute rest, the use of tonics, cod-liver oil, and good food. Counter-irritation, unless pain is markedly present, is uncalled for and ill-borne.

Continuous Absorption, and progressive removal of the whole osseous elements, occur in the bodies of the vertebræ, as the results of pressure ; as is seen in the gradual action of an aneurismal tumour, or in the progressive involvement of the texture by the development of a cancerous or other growth originating elsewhere, and pressing upon the bone.

Caries, or ulcerative destruction of the bodies of the Vertebræ—Pott's disease—is a most formidable affection, and unfortunately not of rare occurrence. It is the ordinary cause of the *acute antero-posterior curvature*, usually termed *angular*. When, however, the disease affects only a small portion of the bone, or when the extent of the vertebral substance, undergoing the preliminary inflammatory softening, is so great, that the patient at an early period is obliged to maintain the horizontal position—there may be no distortion whatever ; but these modifying conditions are rare compared to the frequency of the disease, and the existence of the characteristic deformity. The friends of the patient usually attribute its origin to external injury ; but although this is sometimes

the case in adults, in children the accession is seldom really connected with any obvious exciting cause. In adults, the disease occurring in the lumbar region, is sometimes referrible to venereal excesses. However occasioned, it follows the ordinary course of caries elsewhere ; usually limited to two or three bones, and their intervertebral cartilages ; sometimes, indeed, though rarely, originating in the latter texture. It never involves any considerable number of the whole chain. Its most frequent site is in the dorsal region, and it occurs most commonly in children under ten years of age. Usually it is associated with, and probably dependent on, the strumous diathesis. Sometimes obscure spinal symptoms precede the open development of the disease ; such as pain, uneasiness, numbness, and weakness in the limbs ; spasmodic twitchings ; a sense of tightness round the chest corresponding to the bones affected ; obstinate bowels ; alkaline urine, with trouble in discharging it. More commonly, in the part, which is usually slightly swoln over the affected vertebræ, there is dull uneasiness, and ultimately pain, which is increased by pressure, and rendered intense by sharp percussion—or by motion, as when the patient attempts to stoop or turn in bed. The gait is tottering and uncertain ; for the limbs are shrunk, benumbed, and more or less rigid and tense ; and at this stage the condition of the extremities is due not to mechanical pressure on the spinal cord, but to irritation of this organ, produced by the inflammatory process affecting the neighbouring bodies of the vertebræ. The back, in walking, is kept peculiarly stiff, so as to avoid movement of the diseased bones. When the curvation is advanced, the patient usually, in walking, seeks to take as much weight off the spine as he can, by placing his hands upon the front of the thighs or knees. As matter forms, symptoms of paralysis gradually manifest themselves ; affecting different parts, according to the site of the vertebral disease ; and motion is usually impaired before sensation—as can readily be understood, on reference to the anatomical arrangement of the nerves given off from the spinal cord. If the patient's limbs are not paralysed, and he maintains the erect posture, angular curvature, forwards, advances more and more. The matter, in which the carious mass is bathed, gradually accumulating, seeks an outlet, and points at some part of the surface—in the loins, when the disease is situated in the dorsal vertebræ—or at some more distant point, as in the groin, above or below Poupart's ligament—having made its way to this situation along the course of the psoas muscle, on one or both sides. As the matter makes progress, and is no longer confined and bound down close to the bone, the patient is usually much relieved, both as regards ease from pain, and by disappearance of the paralysis, should this have occurred. The ultimate result may be cure by ankylosis ; the inflammatory softening of the bone stopping short of manifest suppuration. The curve, however, remains permanent ; in fact, rather increases during the process of consolidation and fusion, which results in the bodies of the affected vertebræ. Much more frequently, the issue is fatal ; either occurring rapidly, after suppuration has taken place, by the effects of pressure on the spinal cord ; or more gradually, and not until the abscess has been evacuated, by hectic and exhaustion. Sometimes, but rarely, the suppuration diminishes, the abscess-sac and the

sinus leading from it gradually contract, with or without discharge of fragments of dead bone, and a cure by cicatricial consolidation gradually ensues.

Treatment consists in affording absolute rest to the part, by confinement to the recumbent, or better still, to the *prone* posture. In fact, the prone couch, employed constantly, day and night, will be found in most cases a great assistance in treatment; becoming, after a time, not only not irksome, but absolutely agreeable to the patient; especially when so managed, in the case of children, as to avoid, as far as possible, even the very appearance of restraint. In all cases, mechanical adjustment of the distorted spine by force, or by the use of apparatus, is manifestly at variance with both surgery and sense. At the same time, every attention must be paid to the general health, with long continued administration of cod-liver oil. In the strumous cases, especially in children, there is no advantage to be obtained from the use of active counter-irritation, which sometimes might even threaten to accelerate the fatal issue by exhaustion. In such patients, we are to content ourselves with rest and general management, with a gloomy prognosis. In adults, the actual cautery is only serviceable at the commencement of the disease. When pain and other symptoms indicate the presence of acute inflammatory change, and when suppuration has occurred, its employment only hurries on the fatal issue.

Caries of the two upper cervical vertebræ and occipital condyles, is more common in adults than in children. It commences in the same manner, and is of the same nature, as the disease just described. In speaking of affections of the neck, we have already considered its symptoms, progress, and treatment.

Lumbar, Psoas, and Iliac Abscess.

By *Lumbar Abscess* is understood a chronic collection of matter pointing somewhere in the loins, usually to one side of the spinal column. It sometimes originates wholly in the soft parts. More frequently it is the result of caries of the dorsal vertebræ. When this is the case, it is preceded by the symptoms of Pott's disease of the spine, with or without the existence of the characteristic acute angular curvature. It tends most commonly to form in those patients who have early and long been confined to the recumbent posture. When the collection of matter is connected with disease of the lower dorsal or lumbar vertebræ—or when its source is even higher, in patients who have been able to move about throughout the antecedent progress of the disease—it usually points in the groin, having descended along the course of the psoas muscle on one or both sides. The affection is then termed *Psoas Abscess*; and it, too, may occasionally be found unconnected with disease of bone.

When the matter, situated in the lumbar region, or in the groin above Poupart's ligament (*Iliac abscess*), makes its way to the surface, it has to perforate both muscular texture and dense fasciæ; the aperture of communication between the deeper collection and the subcutaneous abscess is usually, therefore, comparatively small; from which circumstance, either after, but more commonly before evacuation, the swelling

may be mistaken for a subcutaneous affection. Again, an abscess, forming in connection with disease of the vertebræ, may first point in the lumbar region, then above Poupart's ligament, then beneath it; sometimes it makes even further progress, passing to the back of the thigh, and bulging in the ham; and in one case I have known it to extend as far as the inner side of the tendo Achillis, the patient dying of exhaustion before evacuation occurred. Sometimes the matter bursts internally, into the bronchi, into the pleural cavity, or into the large intestines; these results are, however, quite exceptional. Pointing in the situation of the external abdominal ring, or to the inner side of the femoral vessels, the tumour thus formed may simulate a reducible hernia; but is readily distinguished by its spontaneous retrogression on the patient assuming the recumbent posture, and by its spontaneous and gradual reproduction whenever the patient rises, even although pressure by the fingers be maintained over the opening of exit. Treatment depends on the nature of the case. If there be no prospect of ultimate cure, and the abscess causes neither pain nor serious inconvenience, no opening should be made; the ordinary palliatives are to be administered, and every care is to be taken to keep the integuments entire. If the case present a favourable aspect, on the contrary—the presence of disease in the spine being doubtful, or apparently limited to the immediate neighbourhood of the abscess, while the system is little if at all affected—a free evacuation should be made by incision. By the inflammatory irritation following on such opening, if the abscess be an uncomplicated one, we may obtain such spontaneous change in the state of the sac, as will secure its healing. In some cases, portions of dead and loose bone are evacuated; after which, cicatrization of the sac ensues.

Sometimes subcutaneous puncture with a trocar and canula, and partial evacuation of the contents of the sac, as in ordinary chronic abscess, may be adventured upon, to stay the progress of the collection. This must, however, be employed with judgment; as putrefactive change and grave constitutional disturbance not unfrequently follow its employment, requiring free evacuation of the collection, and resulting too frequently in death of the patient. When the abscess opens spontaneously, the aperture is often small and valvular, the drain thus established continues, no bad results follow, and by continued care, with the use of cod-liver oil and tonics, and the employment of the prone couch, sometimes wonderful recoveries take place; even after long persistence of the discharge.

Spina Bifida, or Hydrorachitis.

This is a congenital malformation, usually situated in the lumbar region; but it may be in the dorsal, sacral, or even cervical. The posterior laminæ and spinous process of one or more vertebræ are deficient; in consequence of undue congenital distension of the membranes of the cord with the cerebro-spinal fluid. A tumour of greater or less size is thus formed, composed of the ordinary integuments, which may present a nearly normal aspect, or consist of little else than the spinal membranes, having an opaline or bluish translucency. In other respects, the child may be fully and well formed. More frequently, it is otherwise defec-

tive ; the lower limbs, especially, being shrunk, paralytic, or deformed ; and other congenital malformations, of a kind more seriously compromising life, may, but do not necessarily co-exist. The disease is not in itself inevitably fatal. In some cases, manipulation of the sac produces no uneasiness ; in others, symptoms of spinal, or even of cerebral irritation, are at once induced. Hydrocephalus sometimes complicates its progress. In the most favourable cases, the tumour may enlarge slowly, if at all ; and the child's growth may advance uninterruptedly.

When the tumour does enlarge by accumulation of fluid, the coverings grow thin ; and if a small opening forms, the contents drain gradually away, and, the tumour gradually shrinking, the parts become satisfactorily consolidated. Or ulceration occurs ; the tumour collapses ; an inflammatory process attacks the spinal cord and its membranes ; and the patient perishes either directly in consequence, or by hectic.

Curative treatment is attempted only in cases in which interference is called for, on account of enlargement of the sac ; and when, from the otherwise thriving condition of the patient, the case affords a reasonable prospect of successful issue. In some cases, it is enough to palliate and prevent increase. In others, we get rid of the swelling, hoping that the fissure in the spinal column may close ; or, at all events, that such consolidation shall take place as may effectually prevent recurrence of the protrusion. By steady and uniform support and pressure from without, not only is increase prevented ; absorption may also be occasioned ; and the tumour having become slowly discussed, an opportunity may be thus given for closure of the vertebral hiatus. Along with the use of pressure, occasional puncturing of the cyst with a needle may be practised (Sir A. Cooper), so as to expedite the process ; or the fluid may be at once drawn off with a small trocar and canula. And the injection of tincture of iodine, as for hydrocele, has been not only proposed, but actually practised with an alleged good result.

By including the tumour in two elliptical incisions, which penetrate the whole thickness of its coverings, the fluid is at once evacuated ; and then, on bringing and retaining the margins of the wound in contact by means of wire sutures, such a degree and kind of traction is made upon the parts beneath as may favour, very much, the desired closure of the spinal fissure.* In dissecting away the part included in the elliptical incisions, care must be taken to injure the nervous expansions on its internal aspect as little as possible. The head, too, should not be kept high ; otherwise the fluid of the sheath is apt to escape too suddenly. This operation is warrantable only in those cases in which the fissure is slight, the tumour pedunculated, and other circumstances favourable. As a preliminary to it, the tumour having been tapped, the lateral pressure of a clamp has been employed with the view of producing adhesion of the opposed surfaces of the sac, before resorting to removal of the bag of integument and sac beyond the level of the circumjacent surface. After such proceedings, there is obviously very great danger of the induction of fatal results, from inflammatory seizure of the spinal contents. The simplest of all—puncture with needles, or the use of the small trocar

* Dubourg, *Gazette Medicale de Paris*, Juillet 31, 1841 ; and *Brit. and For. Rev.* No. 24, p. 547.

and canula---having been followed by death from acute or chronic meningitis.

Malignant Disease.

The spinal column is occasionally affected by malignant disease, either primarily or by secondary implication ; an affection which is fortunately rare, seeing that in all cases it must be quite incurable. Its chief importance lies in the diagnosis ; liable as it is to be confounded with inflammatory disease, or, when within the thorax, with aneurism.

CHAPTER LII.

INJURIES AND DISEASES OF THE CHEST.

Fracture of the Ribs.

THE ribs are liable to fracture, usually from direct violence by a blow, or a fall upon the side, or from a crushing weight acting either directly upon the site of fracture, or over the sternum, and approximating it to the spine. The ordinary seat of injury is in the anterior third, or near the middle of the bones. The fracture may, however, be situated posteriorly, near the angle of the rib; and no portion of the bone is free from the risk of breaking by direct violence. Violent contraction of the diaphragm, as in cough, has been occasionally known to produce fracture of one or more ribs. The fifth, sixth, and seventh, are most liable to injury, but any or all may break. The signs are, pain at the part, sometimes with discoloration and swelling; difficult breathing; full inspiration impossible—the attempt causing such aggravation of pain as to catch the breath; obscure crepitus felt, when the palm is held over the part, during respiratory movement; or crepitus and mobility over the site of injury, when the rib is followed from before backwards by the fingers pressing heavily upon it. When the fracture is situated near the angle or neck of the rib, its detection must be a matter of pure hypothesis—at least in most cases; and even when the lesion is in the middle or anterior part of the rib, diagnosis may be difficult or impossible, from the patient's inability to bear the requisite manipulation. Displacement, except in gunshot fractures—or occasioned by some excessively violent injury producing penetration, or complete crushing in of the thoracic walls—is seldom great; and, when caused by direct violence, is usually inwards. When, however, the fracture has been produced by a force acting upon the sternum, and compressing the chest, the displacement may be outwards. The injury may be compound, with corresponding wound of the integuments. More frequently it is compound internally, by wound of the costal and pulmonary pleuræ, and consequent communication with the lung; the integuments remaining entire. Under such circumstances, emphysema can scarcely fail to occur, to a greater or less extent; air escaping into the pleural cavity, from the lung, and during expiration becoming thence forced into the subcutaneous areolar tissue—puffing up the surface of the chest, and probably also extending to the neck. Inflammatory affection of the pleura is also not unlikely to supervene, with or without the complication of puncture of the lung, as can readily be understood. Although, in a healthy patient, fracture of one or several ribs, even if followed by inflammatory complication, is usually speedily

recovered from, in many patients it forms the starting-point of serious thoracic mischief. Sometimes the injury to the ribs and thoracic walls is the least part of a severe crushing force acting on the chest ; laceration of the lungs, heart, and great blood-vessels, accompanying such accident, or even occurring when the elasticity of the walls of the cavity has secured the safety of the ribs and sternum. When the lower ribs are fractured, the corresponding abdominal organs are of course the parts subject to coincident rupture. These circumstances should be borne in mind, in forming an estimate of such a casualty, when it comes to be a subject of medico-legal inquiry.

The objects of treatment are, to prevent motion, and to avert inflammatory or other untoward consequences. A broad flannel binder is applied, and pinned tightly round the chest ; the effect of such support of the thorax being to reduce the respiratory movement of the ribs to a minimum. To prevent the bandage gradually working downwards, broad shoulder-straps should be attached to its upper margin in front and behind ; and in severe cases it is well to keep the arm still by supporting it in a sling. With the view of forcing outwards the fragments of the rib or ribs, maintaining them in more accurate contact than they otherwise would be, and also removing their sharp extremities from the pleura, which they might seriously injure, Petit and Lisfranc recommend, in cases of fracture from direct violence, that a compress should be laid along the sternum, so as to make that surface equally salient with the spinous ridge of the vertebræ ; after which the ordinary thoracic bandage should be applied. Although excellent in principle, however, this device is not found to afford any more satisfactory result in practice than the simple bandage. In severe cases, when the cavity of the pleura contains much air, extravasated blood, or serous accumulation, bandaging must be conducted with great caution, lest it seriously aggravate the already existing dyspnœa. In some simple cases even, the patient cannot bear the pressure of the binder ; and in such circumstances it has been suggested, that support should be given to the affected side only, by means of long strips of adhesive plaster, applied diagonally across the chest, at right angles to the axis of the ribs, so as to control their ascent during respiration (Hannay*). In most cases, it is more convenient to lay the patient upon, or half turned upon, the injured side ; thus securing its quiescence, while the expansion of the sound side is left uninterfered with. Confinement to bed is expedient, in all cases, during the first few days. Rigid antiphlogistic regimen is enjoined ; and active antiphlogistics are not delayed, if pleuritic or other inflammatory accession threaten in the chest. Cough, laughing, talking, and every cause of unnecessary movement of the chest, should be avoided, if possible. Opiates will always check the tickling cough, should treatment for it be deemed requisite. The bandaging is likely to limit or prevent emphysema ; but if this prove diffusive and painful, relief should be given by punctures. Ordinarily, it does not occur to a great extent, and spontaneously disappears in the course of a few days.

* Med. Gazette, November 1845.

Dislocation of the Ribs.

Post-mortem examination has shewn that the head of the rib may be displaced from its connection with the spinal column, without fracture. Such an accident must be a very rare one; and displacement can only occur to a very slight extent. The injury cannot be distinguished from fracture during life, and requires the same treatment. The costal cartilages are sometimes separated from the sternum, and the lower ones may become displaced from each other as well. This is still more rare. The thoracic bandage, with pressure applied over the started cartilage, is all that need be employed.

Fracture of the Sternum.

The sternum is sometimes broken by direct violence, and displaced inwards. The junction of the upper portion with the central, or some part of the central portion, is the common site of this injury; the xiphoid cartilage and its attachment rarely sustaining fracture or separation. The fracture is usually transverse; and the lower fragment, the more prominent—sometimes actually riding over the upper. The signs are plain; deformity by displacement being at once discernible, and crepitus being felt during the backward and forward movement of the lower fragment during each respiratory act. Treatment is as for broken ribs; and here assuredly without any compress over the broken bone. There is the same necessity for watchful anxiety as to the state of the thoracic contents as in cases of other thoracic injury.

Caries and Necrosis of the Ribs and Sternum.

These bones are liable to caries and necrosis, in connection with injury, and as results of tertiary syphilis. The ordinary local and constitutional treatment should be put in force; except in those cases of chronic caries in which the disease is slight, and has been of very long duration, in a feeble system. Then, operative interference is apt to prove injurious; and it is well to be contented with mere palliation. In cases, too, where the affection of bone is secondary to suppurative disease of the chest, all active treatment of the affected bone should be abstained from. The external disease is but a symptom, and probably a sequence, of an internal and much more important disorder.

When operation on a diseased rib is necessary, there need be no fear of injuring the pleura, or that bleeding from the intercostal vessels will render the operation hazardous or difficult; for the long-continued irritation has produced such condensation and thickening of those parts which lie between the bone and the pleural cavity, as to afford ample space for manipulation.

Trephining the sternum, recommended first by La Martinière for the evacuation of purulent collection forming in the anterior mediastinum, is not likely to be required in the case of an abscess, while still confined to the posterior aspect of the bone; as the symptoms which indicate its presence, must always be very dubious. When such an abscess points

it rarely makes its way through the bone ; usually manifesting itself on one side, between the costal cartilages, where a sufficient aperture of escape can easily be afforded by means of the bistoury. The only circumstances which might justify trephining would be punctured fractures of the bone, as after sword or gunshot wound, with lodgment of a foreign body, or of fragments of the broken bone—followed by unmistakable signs of suppuration ; or cases of abscess of the mediastinum pointing in the root of the neck and remaining obstinately open, while a probe could be passed downwards for some six or eight inches behind the bone. In cases of abscess forming over the sternum, which, when opened, disclose an aperture in the bone from which pus continues to be discharged, such opening will usually be found to consist of carious bone, and to be the originating cause of the abscess. Should this be the case, the diseased bone may be removed by the gouge, if it resist constitutional treatment. When, however, the opening is a smoothly-rounded cloaca, and the pus seems to collect within, there is no reason why a more free escape should not be afforded by the trephine.

Abscess in the Axilla may be due to some internal cause not easily recognisable ; as, for example, when it succeeds to typhoid fever or scarlatina. In most cases, however, it results from some peripheral irritation communicated by the lymphatics of the arm, which are then tumid and marked by red lines on the surface of the integument of the forearm and arm. Whitlow, onychia, and poisoned wounds affecting the fingers, are among the most common of these sources of the evil ; and irritation of the mamma or nipple in the female may produce a similar effect. The abscess may either be acute or chronic, and in either case always requires surgical assistance for its evacuation ; as the fascia of the floor of the axilla opposes a steady resistance to the matter reaching the surface, and the abscess tends to burrow deeply upwards, as also backwards beneath the scapula. In opening such abscesses, the parts of importance lie to the outer side of the axillary space, close to the coraco-brachialis muscle ; our incision should therefore be made in the apex of the cavity, midway between the anterior and posterior folds of the axilla, and near its thoracic boundary. Having reached the collection of matter, the incision should be extended outwards, so as to afford a free escape for the contents of the sac. Of course, in scrofulous abscesses, the opening should be delayed as in other similar cases. After the matter has been evacuated, the great indication is to keep the forearm supported in a sling, and the arm steadily affixed to the side, so as to prevent all movement, which in this situation tends to oppose speedy cicatrization. Further, in these cases, a good nourishing and stimulating diet will usually be indicated by the condition of the patient. If a sinus remain, without disease of bone, or the presence of a foreign body to account for its persistence, warm sea-bathing, stimulating injections, and change of air, with cod liver oil, should be employed.

Hernia of the Lung, or Pneumocoele.

This affection may be : 1. *Congenital*, from defective development of the thoracic parietes : 2. *Traumatic*, a wound having left a portion of

the parietes open to protrusion ; 3. *Consecutive*, following fracture of a rib, or perforation of the chest's wall by abscess ; 4. *Spontaneous*, protrusion taking place through an intercostal space, during the exertion of coughing, or through the natural apertures at the root of the neck beside the large blood-vessels. The intercostal spaces where this occurrence has most frequently been observed, are those between the seventh, the eighth, and ninth ribs, at their anterior extremity.

When slowly formed, the protruded part acquires a sac from the pleura costalis ; and, from a small beginning, may come to be of great size—its dimensions greatest during forcible expiration. Auscultation reveals nothing in inspiration ; but during forced expiration an intense vesicular murmur is heard, similar to that of normal inspiration, and sometimes accompanied by a kind of crepitant *râle*. At the same time, too, an impulse is given to the hand, and the “ vesicular rustling ” may be felt as well as heard.

In the *traumatic* form, reduction is to be effected, if, as will usually be the case, the portion of lung be recently protruded and in a fit state for replacement. Otherwise, it has been the usual practice to remove it by incision. If left to itself, the part becomes of a dark colour, which has been mistaken for sphacelation. But it is probably not of so serious a nature, as no real strangulation occurs ; and on this account, especially if adherent to the margin of the wound, the protrusion had better be left alone.

In the other forms, the protrusion is reduced, and a firm compress and bandage worn continuously to support the thoracic parietes at the weakened part.

Bruise of the Thorax.

This, when confined to the walls of the cavity, constitutes a very common, painful, but not serious injury, requiring only that as complete repose as is possible should be afforded to the injured side. This is best effected by means of the binder applied as for fracture of the ribs. Considerable anxiety in cases of such injury may, however, be excited in the mind of both practitioner and patient, by a doubt as to the presence of fracture of the ribs, or consecutive pleurisy. In some cases it is impossible to make a differential diagnosis between fracture of the ribs and bruise of the chest, especially when the injury has been a direct one, and inflicted posteriorly near the angle of the ribs ; fortunately, therefore, the treatment of both injuries is much the same. By a consideration of the state of the pulse, and by auscultation, all doubt as to the presence of pleurisy should be easily set at rest. Fortunately, at the present day, large depletory bleeding does not constitute an essential part of the treatment of pleurisy ; as there can be no doubt that, in former times, many patients suffering from nothing more than bruise of the thoracic walls, were most unnecessarily subjected to copious general blood-lettings.

In young children, or sometimes even in adults, serious injuries may be inflicted upon the thoracic contents by a crushing force which does not fracture any of the bones. The nature of the injury, its mode of infliction, and the symptoms of collapse which attend or follow upon the accident, are sure to indicate the presence of such serious complications.

Wounds of the Thoracic Parietes.

These vary in character, cause, and effects, as do other wounds ; and, except as to their diagnosis from penetrating injuries, do not require special recognition—as they need merely ordinary treatment.

Wounds which penetrate the Thoracic Cavity.

These may be inflicted by the thrust of a sharp instrument, by the penetration of obtuse bodies, by gunshot, or by the penetration of a fractured rib. Danger is great both at once and secondarily ; immediately it may be, though rarely, by loss of blood, and by entrance of air through the wound into the pleural cavity ; subsequently, and more commonly, by inflammatory results. The last mentioned danger is also the most serious. Penetrating wounds by sharp instruments, when the lungs are injured, are always formidable by bleeding ; while pneumothorax, and inflammatory results, are nearly certain to ensue. But, in the case of an obtuse body penetrating, the elasticity of the lung may save the tissue from injury, which, from a sharply-pointed body, it could not fail to sustain. The symptoms present in all such cases are a sense of oppression in the chest, suddenly induced and gradually increasing, and more or less interruption to the pulmonary circulation, attended by venous congestion of the lips and face due to imperfect oxygenation of the blood. When the pulse becomes feeble, quick, and irregular, and the extremities cold—and when the wound is free and the expansion of the thoracic parietes uninterrupted—although the breathing may be hurried and the sense of oppression great, dyspnoea properly so called cannot be said to exist.

1. *Wounds of the Pleural Cavity.*—If the intercostal artery have been wounded, bleeding is likely to be troublesome ; this however is a rare though occasional occurrence. The loss may be excessive through the external wound ; or, especially when the wound is small and punctured, or situated near the upper part of the chest, without any external indication of hemorrhage, blood is likely to escape into the pleural cavity, and, compressing the lung, to constitute a dangerous hæmato-thorax. To arrest the bleeding, therefore, should engage our first attention ; and to secure the vessel, one of two methods may be adopted. If the wound is an open one, the mouth of the vessel should be exposed, seized with artery forceps, and tied ; or compression by lint, or by the finger of an assistant, should be employed. Some have advised that both the vessel and the adjacent rib should be surrounded by a ligature ; or that a wire, carrying a compress of lint, should be passed round by means of a semi-circular needle. Others have recommended that a bandage having been placed over the part, a fold of it should be pushed into the wound, between the ribs ; and that the linen pouch thus formed within the pleural cavity should be crammed with charpie, by means of a probe or director ; then, by tightening the bandage, and securing it firmly round the chest, that this internal plug should be made to compress the vessel and occlude its orifice. But, indeed, the frequency of wound of the intercostal vessels has been very much exaggerated ; and in most cases

the ordinary hemostatics, ligature and pressure, will not be found to fail. The most serious cases of injury of the intercostal arteries, are when the wound is an oblique and punctured one ; or when, from fracture of the upper ribs near their angles, the upper intercostal arteries have been wounded, and when, without any external manifestation of hemorrhage, copious bleeding gradually accumulates in the thoracic cavity. When, again, the bleeding occurs externally, but the vessel cannot be seen, the surgeon should bear in mind that the flow of bright arterial blood may be from the substance of the lungs. The mere fact, however, that the blood is frothy, should not lead to the decided conclusion that the source is from a wound of the lung ; for, in either case, the blood may be mixed with air.

Entrance of air by the wound, and accumulation of it within the chest, are to be avoided when the wound is small, and unattended by laceration, or copious and unarrested bleeding, by its early and accurate closure. Otherwise, the condition of pneumo-thorax is established ; and if the air enters more freely than it escapes, the lung becomes compressed and collapsed. When, however, the opening in the thoracic parietes is considerable, and does not admit of being closed, as in gunshot wounds, we are able to observe the natural progress of events. Thus, the air both entering and escaping freely, while at the same time the lung is not wounded, immediate collapse of this organ upon the affected side does not either usually or necessarily ensue. It in fact remains passive ; the chest walls moving, and giving to it sometimes even the appearance of expansion during expiration and contraction during inspiration. In other cases, when the patient coughs, and thus closes the glottis during expiration, the forcible inflation of the lung upon the wounded side, by contraction of the sound side of the chest, really produces an expansion of the lung during expiration ; and that to such an extent, that if a considerable quantity of air has entered the thoracic cavity through the wound, the portion of the lung corresponding to the opening in the parietes may even become forcibly protruded, constituting a traumatic hernia of the lung. Under any circumstances, when the function of the lung upon the injured side is much embarrassed, the breathing is consequently rendered imperfect ; and the sound lung, having suddenly a great amount of additional duty thrown upon it, labours in its function, becomes dangerously congested, possibly apoplectic, or attacked by the inflammatory process. These immediate dangers having been surpassed, others remain. The wound, suppurating, may lead to serious affection of the pleura upon the injured side, by extension of the inflammatory process ; and this has to be guarded against by antiphlogistic regimen, in the first instance, followed, if need be, by venesection and antimony. In most cases, however, a putrescent sero-purulent fluid collects in the thoracic cavity, attended with a typhoid condition of system requiring the free use of stimulants instead of evacuants and sedatives.

2. *Wounds of the Pleural Cavity and Lung.*—Here the dangers are from hemorrhage, pneumo-thorax, and emphysema, and, at a later period, from the occurrence of the inflammatory process. There is now a third outlet for the bleeding ; by the bronchial tubes, as well as into the pleural

cavity, and through the external wound. And the hemorrhage, coming from so vascular an organ as the lung, especially when the wound implicates the base, is likely to prove formidable, if not speedily fatal. Here, too, the wounded lung admits of complete contraction, with, in most cases, though not always, the rapid induction of pneumo-thorax—whether the external wound be free or punctured—the air finding its way with each inspiratory movement from the trachea and its branches, through the wound of the lung into the pleural cavity. When the wound is a free one, the atmospheric equilibrium, within and external to the lung, permits the contractile tendency of the organ to develop its full result; while on the other hand, when the wound is punctured, the air finding a more ready access to the pleural cavity through the wound in the lung, and not readily escaping thence, either through the wound in the lung, or through that in the parietes, tends with each expiratory effort to produce more complete collapse of the pulmonary tissue. The usual signs of this injury are—a state of system bordering on collapse, great anxiety of countenance, difficult breathing, bleeding from the wound, and expectoration of frothy florid arterial blood, with *traumatopncea*, when the wound is patent, or the development of emphysema when the wound is punctured, the air, instead of escaping, accumulating in the areolar tissue. Bleeding is dangerous, by direct loss, and by risk of hæmato-thorax; and also by probable accumulation in the bronchial tubes and trachea, during the stage of collapse. Afterwards comes the peril of congestion and inflammatory accession in the lung upon the uninjured side. And, lastly, by profuse and continued discharge from the suppurating wound and pleural cavity, the patient may perish under the symptoms of phthisical hectic. Inflammatory invasion of the wounded lung is one of the serious consequences mentioned by most systematic writers, and by some spoken of as an invariable consequence. It is in truth, however, rather a rare occurrence. When it is demonstrated in a post-mortem examination, the conditions observed, even in cases of gunshot wound, are very different from the red and grey hepatized condition observed in idiopathic pneumonia. The affection is limited to the track of the wound and its immediate neighbourhood; while sloughing and suppuration, except in the mere track of the wound, are rare; and when an abscess forms, it may usually be traced to the lodgment of some foreign body. When such inflammatory result of a lung wound does occur, it is unattended by any of the symptoms, physical or rational, which characterize idiopathic pneumonia.

The first danger is met by rest, quietude, and rigid antiphlogistic regimen; recourse being had also, if need be, to more direct means of controlling the hemorrhage, by inducing coagulation in the bleeding vessels—such as rapid abstraction of blood from one or both arms, the use of bladders of ice applied to the chest, with the employment internally of nauseants, acetate of lead and opium, etc. Rallying and reaction having occurred, antiphlogistics come into use to relieve the congested condition of the uninjured lung. In employing them, the probability of a prolonged and exhausting illness must be borne in mind; and although the written dictum of most surgical writers, at the present day, is in favour of full and repeated venesections, to diminish so far as is consistent with

life the quantity of the circulating fluid, I am inclined strongly to believe that in such cases it has little, if any, effect as an antiphlogistic ; acting rather mechanically, by relieving the congestion of the uninjured side, through diminution of the quantity of the whole volume of blood. In such circumstances, stimulants will be found frequently to afford quite as efficient relief to the dyspnoea when it sets in ; and by the regulated use of ether, ammonia, and opiates, with digitalis, aconite, or antimony—should the state of the hardness of the pulse seem to need these—the congestion of the right side of the heart will usually be found speedily to pass off, the breathing becoming less rapid and oppressed. Hectic having threatened or set in, nourishing articles of diet, with a requisite allowance of stimulants, must be administered. The local management is simple throughout. At first careful examination of the wound is made, in order that no foreign matter, or splinters of bone, within reach, may be permitted to remain. By some, immediate closure of the wound in the thoracic parietes is recommended ; hoping thus to assist in checking the flow of blood, and to diminish the risk of pleurisy. Instead of such a happy effect following, however, putrescence of the blood effused within, and the induction of a typhoid state of system, are almost certain to ensue ; only to be relieved by again opening up the wound, or making a new one in a more dependent position, so as to evacuate the decomposing fluid collected within the chest. Then the part is covered by tepid water-dressing, retained by light bandaging. And the patient is laid, and directed to remain, on the wounded side, so as to favour outward escape of discharge ; while by this posture, also, adhesion is favoured between the corresponding wounded portions of the two pleuræ, so as to shut off the injured part from the general costal cavity. When laceration exists, as in gunshot injuries, great watchfulness is necessary at the time of the separation of sloughs, lest secondary hemorrhage occur. Small doses of aconite are of use in averting this ; by subduing the febrile excitement of the circulation which usually precedes its occurrence.

Lodgment of Foreign Bodies.

These may be of various kinds ; *e.g.*, a portion of a knife or poignard, or of an arrow or lance, a bullet, fragments of shattered ribs, portions of the patient's clothes, a button, money, or some object which occupied the patient's pocket ; portions of lint, as compresses, or tents introduced into the wound, with the view of checking bleeding, or maintaining the patency of the aperture. These may either remain persistently, becoming encysted, and, although a source of more or less uneasiness, creating little or no inflammatory mischief ; or they may excite suppuration, and become spontaneously extruded by the original wound, or by a fresh opening, or by being expectorated—the abscess having evacuated itself into the bronchi.

When the case comes under treatment at a recent period after the infliction of the wound, and the lodgment of the foreign body, this should be extracted if within reach of the finger ; the wound being dilated, if need be, for this purpose. If not, it had much better be left alone ; as all poking with probes, or forceps, on the chance of finding a foreign

substance, is only likely to create further mischief. When the lodgment has existed for some time, and a chronic purulent discharge continues to flow from the wound, careful exploration by means of a probe is then likely to afford more trustworthy information; and, if need be, dilatation of the wound, or even excision of a portion of rib, may be found necessary, for exploring the portion of the sinus interior to the thoracic cavity with the finger, or for extracting the foreign body when recognised. When the foreign substance is metallic, it may become encysted; or, according to the observation of some surgeons, in a few rare cases, it may lie loose in the cavity, and move with every change in position of the patient's trunk. In such circumstances, no interference is either indicated by symptoms, or permissible in practice.

Hæmato-Thorax.

This term denotes an accumulation of blood in the pleural cavity, causing more or less compression of the corresponding lung, with the concomitants and consequences of this, already noticed. It may be produced by spontaneous escape of blood, through rupture—as in aneurism; much more frequently it is of traumatic origin—by wound of the lung, or of an intercostal artery. It may be either simple or compound; the latter, if the result of a penetrating wound; the former, if caused by puncture of the lung, or of an intercostal artery, in a case of fractured rib with much displacement of the sharp ends of the bone—the integument remaining entire. According to the extent of accumulation, respiration is more or less oppressed; there is dulness on percussion over the dependent part of that side, and no respiratory murmur can be heard; on the opposite side, respiration is *puerile*; the patient can lie only on the affected side; the countenance is anxious; the general surface is cold and pale, and the face and neck are bedewed by a clammy sweat; there is also feeble pulse, with cold extremities, suppression of urine, and other signs of serious loss of blood. In cases of hæmato-thorax occurring some days after the infliction of the wound, the corresponding side, from the false ribs to the quadratus lumborum, has often been observed of a violet colour. The ordinary ecchymosis, however, which constantly forms in the immediate neighbourhood of the wound shortly after its infliction, must not be mistaken for this symptom, first described by Valentin.

If the affection be not compound, and slight in other respects, treatment is analogous to that of sanguineous collections in the external parts of the body, following bruise. Incisions into the cavity of the thorax should be abstained from, though recommended by some in cases where the bleeding is presumed to come from a wound of the lung, as a means of checking the flow by causing collapse of that organ. In most cases the blood gradually disappears by absorption. Bags filled with fragments of ice should be applied to the chest; the patient should be laid upon the injured side, and kept as still as possible, while nothing but cold fluids, and these in as small quantities and as little stimulating as possible, should be given. Venesection may be advisable in some few cases, to arrest bleeding, and so to limit the accumulation; diminishing also the amount of circulating fluid in the labouring sound lung, and

at the same time mitigating inflammatory disease in all the injured parts. If, however, the accumulation be obviously great—as evidenced by the amount of dulness and fulness of the side, and by the oppression in breathing—it may become necessary to afford the confined blood means of escape, by making a suitable opening in the parietes.

In the compound form, the wound is left open, and the patient laid upon the injured side, so as to admit of the escape of all the blood which would otherwise collect within the cavity of the chest, and become there putrescent. To make this escape more certain, a counter-opening may even be required; and is to be preferred to the introduction of syringes to wash out the cavity, or of drainage tubes to draw off the fluid. The means already mentioned are taken to arrest the bleeding; and should its source, and the symptoms of its existence, be doubtful, it may even be prudent to open the wound to ascertain, so far as is possible, the real state of matters.

Pneumo-Thorax and Emphysema.

Pneumo-Thorax.—This denotes accumulation of air in the pleural cavity. The case may be either medical or surgical; the latter sometimes occurring when the pleural cavity is opened, and the lung unhurt, but more commonly dependent on wound of the lung; the former caused by perforating ulcer, connected with tubercular abscess. The traumatic form is the result of penetrating wound, oblique and valvular; or of fractured rib, displaced inwards. It has also resulted from mere bruise of the chest; the lung and pleura pulmonalis having given way by rupture. Its signs are:—absence of the respiratory murmur on the affected side, with a peculiarly clear tympanitic resonance on percussion; the thoracic wall and the ribs are fixed; and, on the opposite side, respiration is puerile, as in the preceding affection. In the medical form, there is usually fluid as well as air in the chest; consequently a splashing of this fluid is heard, on (Hippocratic) succussion; and coughing or speaking produces a ringing sound, termed metallic, or amphoric resonance.

Treatment consists in affording ease to the working lung, and averting inflammatory accession. Judicious loss of blood, as already seen, conduces powerfully to both objects. In urgent cases, an outward escape is to be afforded to the air; and one or two limited incisions into the areolar tissue in the neighbourhood of the broken ribs, when emphysema complicates the pneumo-thorax, will generally relieve both conditions. When, however, there is no emphysema, or when such incision affords no relief, paracentesis, by means of a small exploring trocar and canula, may be required. Care must of course be taken, before resorting to this, that we are certain upon which side the pneumo-thorax really exists—a matter sometimes of difficulty where both sides are injured, and emphysema is extensive.

Emphysema sometimes co-exists with *Pneumo-thorax*. We have already seen that the air may enter the cavity of the thorax through a valvular wound during inspiration, and instead of escaping freely during expiration, become diffused into the areolar tissue around and in the neighbourhood of the wound. In other cases, as *e. g.*, where a fractured

rib has wounded the lung, the air, escaping from this organ during the inspiratory movement of the chest, is forced with each expiratory effort through the wound in the pleura costalis, and thence into the areolar tissue ; and in this case not only may the emphysema distend the areolar tissue in the immediate neighbourhood of the injury, but even of the whole body—the palms of the hands and soles of the feet alone excepted. Such general diffusion, however, is rare, its extent being usually limited to the affected side. The condition is recognised by the uniformly diffused but ill-defined character of the swelling produced by the confined air ; the surface of the skin presenting a white appearance and a diminished temperature, and crackling and dimpling under the pressure of the finger, while the depressions left rapidly disappear. The treatment of the affection consists in the application of a compress over the site of the pleural aperture, and in the employment of punctures or limited incisions to afford relief to the tension and uneasiness induced. When the emphysema is limited, nothing beyond the application of a binder round the chest is required, and the air spontaneously disappears within a brief period.

Paracentesis Thoracis.

An opening into the pleural cavity may be required, we have seen, on account of the accumulation of air or blood. It may also be needed in consequence of fluids having collected there—the result of dropsical effusion or of inflammatory disease—Hydro-thorax, Pleuritic effusion, and Empyæma ; affections which belong to the department of the Physician, and whose progress and consequences it is unnecessary to consider here. In all of them, when the intervention of Surgery is needed, the side is found dull on percussion, and swollen, and the ribs are unusually separate, the interspaces bulging ; there are dyspnœa, difficulty of lying on the sound side, and the other signs of pleural accumulation already noticed ; the side enlarges more and more, and even fluctuation may come to be discernible in the intercostal spaces ; and ultimately, in cases of empyæma, spontaneous evacuation may take place at the most prominent part, as in ordinary abscess.

For the discharge of purulent and sero-purulent fluids, an opening is made by means of a trocar and canula. This instrument may be employed, subintegumentally, as in the case of chronic abscess. Or, in some cases, the opening may require to be made direct, by means of the bistoury, and left patulous and dependent. However made, the margins of the ribs should be carefully avoided—especially the lower border of the upper rib, beneath cover of which the superior and larger branch of the intercostal artery runs. In the direct puncture, it is well to make a preliminary incision through the skin and muscular stratum, by means of a scalpel ; merely completing perforation by the trocar. As to the most eligible point for making such a wound, authorities greatly differ. The opening must be dependent, and sufficient in all respects for evacuation, and therefore should not be made higher than the fifth or sixth rib ; and yet it must not be so placed as to endanger the diaphragm—which would be the case were the puncture made lower down than the ninth or tenth rib ;

though this part, it is to be remembered, when paracentesis is required, is usually displaced downwards very considerably by the accumulation, and is further protected by the patient being directed to inspire during the act of puncture. The space between the fifth and sixth ribs is frequently chosen, midway between the spine and sternum. Some prefer that between the sixth and seventh; others operate between the seventh and eighth. Some have gone as high as between the fourth and fifth ribs, having observed that natural pointing not unfrequently takes place there. Of late, the space between the sixth and seventh, or that between the seventh and eighth has been opened, by cautious dissection and the thrust of a small trocar, at the most dependent part—below the lower angle of the scapula. Upon the whole, puncture between the fifth and eighth ribs upon the right side, and the sixth and ninth upon the left, midway between the spine and sternum, seems the site most appropriate. The patient having been placed with the side prominent and dependent, and arrangements made for turning him on his face, should oppressed respiration ensue, a small trocar and canula are introduced directly into the thoracic cavity; and the trocar being withdrawn, the fluid flows in a steady stream through the canula; the utmost care being taken to prevent entrance of air into the pleural cavity. To render this, if possible, more secure, the trocar and canula may be included within a closed bladder emptied of air and containing water, the fundus of which is provided with a stopcock which can be opened in a dependent position below water, when the trocar has been withdrawn from the canula; others employ syringes with valves adapted to a drainage, or stopcock-trocar, by means of which the cavity of the thorax is pumped empty. Enough having been removed, as the canula is withdrawn the greatest care must be taken to avoid the entrance of air; the patient is exhorted to shallow breathing; and the wound is instantly shut up, the puncture being treated so as to secure immediate union. Subsequently, the operation may be repeated, if necessary. Relief is certain, for the time; and, in not a few cases, this adaptation of surgery to medicine seems to have been instrumental towards a permanent cure. In the case of empyæma acutely formed, or ensuing upon a wound situated too high to afford an efficient drain to the fluid, a direct opening by incision should be made; and if permanency seem preferable to closure and re-opening, as will usually be the case, this is secured by interposing a bit of lint between the edges of the wound. To favour discharge, the patient remains recumbent on the affected side; and in some cases where the empyæma has gone on for months discharging, and the side has contracted so that the ribs are imbricated over each other, removal of a portion of bone may be required to afford a sufficiently free opening for escape of the matter collecting within.

Wounds of the Heart.

These may be inflicted by cutting or pointed weapons, varying much in size, or may result from gunshot injury. They generally prove fatal; but are not necessarily so, either immediately or ultimately, the patient in a few exceptional cases living for days, weeks, or even years after the

infliction of the wound. The size of the wound, its situation, or the mode of its infliction, do not seem to influence the result so much as the direction in which it has passed, with reference to the fibres of this organ. In man, while the smallest punctures, such as those with a needle or pin, have proved speedily fatal, more serious injuries have been long survived or even recovered from. Dr. Grace of Cupar-Fife attended a patient, who died in two days after puncture of the right auricle of the heart with a large needle. Villeneuve, the French admiral opposed to Nelson at Trafalgar, who died suddenly, is said to have committed suicide in this way. Dr. Murray Dobie had under his care, when a house-surgeon in the Infirmary, a child which died within a few days after a puncture of the heart with a darning needle. The Duc de Berri lived only eight hours after a wound of the right auricle with a saddler's awl. In 1728, a gentleman attached to the Sardinian Court died suddenly, from a puncture with a golden needle inflicted by his wife when he was asleep. On the other hand, in the fourteenth volume of the Medical Gazette, the case of a boy is narrated who lived five weeks after the transfixion of the right ventricle of the heart by a wooden pin three inches in length, which was found lodged there after death. We also find the case of a patient who survived three weeks with a watchmaker's file run through both ventricles.* In the fourteenth volume of the Edinburgh Medical Journal, the case of a patient is narrated who lived fourteen days after a gunshot wound of the heart sustained at Corunna. M. Manton mentions a case where, after death, a ball was found lodged in the substance of the heart, six years after the receipt of the wound. Dr. A. Christison† gives the dissection of a patient, a private of the 80th regiment, in whom a ball was found lodged in the left ventricle, more than two months after a gunshot wound received in the Burmese war; seeming to have entered through a wound in the lung, and passed into the heart along the pulmonary vein.

The cause of death, in cases where the accident has proved fatal, has been hemorrhage, pericarditis, or sudden and fatal syncope some time after its infliction. In other cases, death has apparently ensued from some cause quite unconnected with the wound. When patients have recovered after such lesions, the presence of a cicatrix marking the line of wound and corresponding to a continuous track in the pericardium and external parts, or the presence of the foreign body either in the wound or lodged in one or other of the cavities of the heart, will suffice to prove that such an injury has really been inflicted. In stags, a cicatrix in the cardiac wall, with the bullet lying loose in the ventricular cavity, has been observed with sufficient frequency to render the possibility of recovery after a wound of the cardiac wall, in man, quite within the range of possibility.

The symptoms in wounds of the heart, besides the site of the injury, are those of great depression of the whole system, terminating in syncope and death from internal bleeding, or gradually rallied from, and at a later period followed by a fatal issue from reproduction of the hemorrhage,

* *Repertoire d' Anatomie et de Clinique Chirurgicale.*

† *Edin. Monthly Journal of Medical Science*, Dec. 1852, pp. 551-2.

or from pericarditis, or from gradual exhaustion. These cases admit of no other treatment than strict repose, and the employment of every measure, dietetic and medicinal, to diminish the force of the heart's action. If syncope occurs, no artificial means should be employed to hasten reaction. If the wound has been closed, and blood seems to be collecting within the pericardium, embarrassing the heart's action, the aperture should be again made free and left open.

Wounds of the *great vessels within the thorax* are in general immediately fatal, and marked by the symptoms of rapid internal hemorrhage. Exceptional instances are, however, on record, where the patient has survived a wound of the aorta for a considerable period ; but in all such cases a false aneurism has formed.

The vena azygos, when wounded, has given rise to a fatal hemorrhage.

The Internal Mammary artery may be opened in the three upper intercostal spaces ; below this point, the vessel can only be injured by a wound which divides the cartilages. Below the third space, the vessel becomes so small that serious internal bleeding would not be likely to ensue, were it not that the pleural cavity is usually opened also, and affords a receptacle for the blood. This artery has been tied in the third intercostal space, at a point about three lines from the sternal margin. The incision for this purpose should be oblique ; the skin, areolar tissue, origin of the pectoralis major, and anterior intercostal muscle, require division, when the vessel will be found lying upon the pleura, and separated from it only by areolar tissue.

The difficulty of diagnosing the existence of bleeding as proceeding internally from this source, is even greater than in the analogous case of an intercostal vessel. Should symptoms of internal hemorrhage accompany a wound in the line of the artery, the wound should be opened up ; and, the bleeding having been traced to this source, compression will usually be found the most available measure for its successful arrest.

CHAPTER LIIL

AFFECTIONS OF THE MAMMA AND MAMMILLA.

Irritable Mamma.

THE female breast is not unfrequently the seat of irritation ; giving rise to much local uneasiness, and tending also to involve the system in serious disorder. The gland may be partially or wholly affected, but is little, if at all, diseased in structure ; sometimes there is only slight puffiness in the superficial areolar tissue ; or the texture of the lobules is unusually firm, and when cut into whiter and denser than in the normal state ; sometimes, also, the affected part contains one or more small lactiferous cysts, varying in size from a pin's head to a coriander seed, filled with a clear serous fluid. The pain, which is the chief characteristic of this disease, is very considerable ; not constant, liable to exacerbations, often periodic, and otherwise evincing the ordinary characters of neuralgia. Aggravation generally occurs at the menstrual period. The patient is usually about the middle age ; and generally pale, thin, and cachectic, of a nervous temperament—often under the influence of mental depression due to grief, disappointment, or anxiety.

The affection is to be considered as symptomatic of more serious disease, and treated accordingly. In the majority of cases, the uterus is to blame—disordered either in structure or in function ; and until this source of evil be rectified, all other treatment will prove of little avail. In cases of functional derangement, the preparations of iron are indicated ; and conium is sometimes of service in allaying the general irritation of system. Locally, the endermic use of nitrate of silver, so as merely to blacken, often affords relief ; and belladonna, aconite, and prussic acid, may be used in the form of ointment, liniment, or plaster. Change of air, exercise, attention to diet, and the other ordinary correctives of chronic disease, are of great importance. In some cases the symptoms seem dependent on neuromatous formation in the neighbourhood of the gland ; and under such circumstances, cure may be readily effected by excision of the superficial tumour, or even of the affected portion of the breast—especially in those cases where the patient broods night and day over her sufferings, and evidently suffers from an irrepressible fear of malignant disease. Sometimes, however, even the removal of the whole breast affords no relief ; the pain continuing in the cicatrix, or becoming transferred to the other breast.

Mammitis.

Acute.—The acute inflammatory process in the mamma, especially

during lactation, may result from external injury, exposure to cold, derangements of the gastro-intestinal system, errors in diet, or any other circumstance which suffices to excite the general febrile disturbance, commonly designated as a "*weel*." This is characterized by rigors, shivering, quick pulse, loaded tongue, intense thirst, flushing of the face, and even delirium, while the pain and other local inflammatory symptoms are commensurately intense; and suppuration is obviously imminent from the first. The secretion of milk is first perverted, then arrested, and, should resolution occur, again restored. When matter forms, it is seldom limited to one part, pointing rapidly there; but rather tends to pervade the whole gland, pointing slowly, and, when allowed to evacuate itself spontaneously, usually attended by more or less ulceration or even sloughing of the integument.

In the outset, leeches are generally recommended to be applied in abundance; but hot fomentation to the part, while the gland is carefully supported by a soft handkerchief or shawl, passed beneath it and round the neck, will be found more advantageous. Internally, small doses of sulphate of magnesia, in acidulated solution, with antimony, will usually subdue the febrile state, at the same time having the effect of checking the hyper-secretion in the gland—a result which will be further contributed to by local use of belladonna. When resolution commences, this may be accelerated by gentle friction. When suppuration sets in, as is usually indicated by the occurrence of rigors, poultices should be applied, and the diet should be restricted as much as possible. When matter has formed, it may be expedient, unless the pain is excessive, to delay evacuation till the matter has approached the surface, and the red and prominent integuments indicate that it is superficial—quite an exception to the ordinary rules of surgery in like circumstances; for thus, the cavity of the abscess is thought to heal sooner, and without the formation of sinuses—thus avoiding future severities by incision. The direction of the incision should radiate from the nipple towards the periphery of the organ, as there is thus less likelihood of troublesome bleeding. There is certainly no advantage in allowing the abscess to follow its own course; for in severe or neglected cases, the gland may be, as it were, dissected out by the pus separating its component parts; or many sinuses may form, communicating with each other, intersecting the whole mamma, and mixed up with intercurrent abscess. When such sinuses exist, they do not require to be each incised throughout their whole extent, as was recommended by Mr. Hey of Leeds, instead of the still more severe practice of his day; it is enough to secure satisfactory evacuation by dilating the orifices, or by affording a suitable counter-opening, and then, by pressure and the use of astringent and stimulating injections, to favour contraction of the cavities. In this we generally succeed; and continuance of the pressure is further useful, in promoting discussion of the morbid induration by which the track of the sinuses is surrounded. It may be applied by bandaging, by careful application of strips of adhesive plaster, or by means of the air or water cushion, as recommended by Mr. Arnott.

Chronic.—The mamma is subject to enlargement and induration, by reason of a slow and almost painless inflammatory change. This may be

due to menstrual irregularity, or external injury ; and the whole of both glands, or only a part of one, may be affected. Middle aged, and unmarried or childless women, are most liable to suffer. The swelling is more diffuse than any form of genuine tumour ; and is little painful, even on manipulation. When the gland is flattened out upon the pectoral, it feels as if composed of numerous small granules ; while when manipulated between the fingers, it may closely simulate the characters of a cancerous affection. The age and appearance of the patient, the burning character of the uneasiness which attends upon it, if pain be present at all, the absence of the *hardness* of true scirrhus, and the satisfactory result of treatment, will serve to characterize the simple nature of this affection. Treatment consists, locally, in leeching if much pain is present, followed by warm fomentation, and thereafter by the use of discutients ; while in other cases, pressure and support, by means of a lead, or gum and mercurial, plaster, should be employed from the first. Constitutionally, attention should be given to the general health, to the state of the digestive organs, and to the uterine functions ; afterwards saline alteratives, iron, and bitter tonics, may be advantageously employed.

Hypertrophy.

The mamma is liable to hypertrophy at the period of puberty—usually with an unsatisfactory condition of the menstrual secretion—and also in the early months of pregnancy. In the former instance, the excitement which attends upon the development of the sexual organs sometimes produces a state resembling nymphomania. The gland or glands become sometimes not only enlarged, but at the same time hard and painful. When abnormal menstruation is the cause of the undue amount of development, this may usually be got rid of by attention to the general health and to the uterine functions—aided, if need be, locally, by gentle leeching, followed by discussives. Of these latter, none are so effectual, locally, as pressure ; and this is very conveniently applied by means of the hydrostatic apparatus of Dr. Arnott. In the pregnant condition, the attendant uneasiness should be palliated by the use of chloroform, or other sedative liniment, if the patient complains much of its continuance.

Partial Hypertrophy.

A portion of the gland becomes hypertrophied, with ultimate change of structure—yet simple ; and enlargement of the lobules takes place usually from the outward surface, constituting a soft unequal tumour. It is peculiar to the young adult ; seldom if ever appearing after thirty years of age ; and is almost always connected with disorder of the uterine system. Treatment is the same as for general hypertrophy. Marriage, followed by pregnancy and suckling, sometimes proves a successful means of cure.

The tumour, though originally most simple, is liable to degeneration. Consequently, when ordinary discussive means have failed, after due trial, it should be regarded as other tumours not amenable to discussion. “Common snakes are killed, because vipers are dangerous.”

Galactorrhœa.—By this term is understood a persistent and excessive secretion of milk ; whereby emaciation, debility, and even hectic, may be induced. To arrest and remove this condition, iodine given internally seems to possess almost a specific power ; suckling being of course desisted from, and the uterine functions restored.

Chronic Abscess.

Chronic abscess is not unfrequently found of a somewhat peculiar character in connection with this gland ; it is usually single, varying in size from a pigeon's to a small hen's egg. The abscess-sac consists of a thin firm cyst, containing a thin, or sometimes a thick creamy-looking pus ; existing for months or years, and enlarging slowly if at all ; situate sometimes deeply in the gland, more frequently beneath it ; firm, because tense, to the touch ; and sometimes closely simulating a solid tumour. To avoid such mistake, the gland should be carefully steadied with one hand, while the swelling is manipulated with the other. The smooth oval outline of the sac, the firm connection between it and the surrounding parts, the existence of fluctuation, more or less obscurely perceived, and the absence of pain, should serve to distinguish it from either a fibrous tumour or scirrhus of the breast ; with the latter of which, when the axillary glands are swollen, it is peculiarly liable to be confounded. If still in doubt, before condemning the patient to an operation, an exploratory puncture should be made with a trocar and canula, or by means of the knife. It may be treated either by sub-integumental or by direct puncture, or by injecting the tincture of iodine when the contents are thin and whey-like. When opened, the cavity should be filled with lint till acute suppuration becomes established ; and after the local and constitutional disturbance has subsided, every care should be taken to prevent healing of the external aperture until the abscess-sac has completely cicatrized.

Lacteal Tumour.

One or more of the lacteal tubes are liable to distension, by occlusion of their orifices ; giving rise to a swelling analogous to other cystic formations. The contents are milky or creamy during lactation ; at other times serous and fluid, or caseous and solid—or partly so. The swelling has a fluctuating feeling on manipulation, and resembles, except that it is larger, a simple cyst, sometimes attaining to the size of a large apple or orange. In other cases it extends, radius-like, from the nipple outwards ; and may even be of a conical form, the apex towards the centre. Treatment is by puncture, near the nipple ; keeping the opening pervious. Should inflammatory change take place, inducing obliteration, the occurrence need not be greatly deplored. Sometimes abscess forms ; requiring the ordinary treatment. And sometimes this simple morbid condition proves the precursor of inveterate carcinoma in the gland.

Pendulous Breast.

The pendulous breast is an affection of advanced years ; being but an exaggeration of the ordinary dug-like condition which this organ so generally assumes, in those who have borne children, and who habitually neglect support of the part in dress. The only warrantable treatment is palliation by suspension and support.

Various Tumours.

The gland may be the seat of *Simple tumour*—*Glandular*, or *Fibro-cellular*. When partial, and not steadily increasing, the affection is virtually a mere hypertrophy. But when the mass becomes absolutely unseemly, a source of great discomfort to the patient, and has attained to a weight which may in some cases even be that of pounds, it certainly deserves to be regarded as a true tumour. The structure consists of a lowly imitative development of the glandular mammary structure, composed of *acini* unprovided with excretory ducts ; and hence the tumour derives the name of *Adenoid* or *glandular*. The treatment in the early stage should consist in efforts at discussion by the use of iodine externally and internally ; and, if that fail, and the growth steadily increase and annoy the patient, excision should certainly be recommended. *Fibrous tumours* have a favourite site here. Their structure varies from that of the “*pancreatic sarcoma*” of Mr. Abernethy, to that of a fibro-cartilaginous tumour ; rarely larger than a billiard ball, but sometimes attaining to a very large size. This fibrous growth is sometimes situated within the mammary gland, but quite separate from its structure. Sometimes it lies beneath, in other cases marginally. It usually occurs in unmarried women between the ages of twenty and forty, and is recognised by its mobility, definition, and painless character. Though less liable to degeneration than any other morbid growth, it is certainly not exempt from that untoward occurrence ; and, therefore, except in the aged, it is well to remove by operation that which can never grow better and may grow worse. For, although actual cancerous degeneration is a rare consequence, softening of the tumour, with ulceration of the cutaneous textures, which have from pressure become adherent to the growth, is far from improbable. Sloughing ensues, and with the separation of the slough, hemorrhage—copious, repeated, and exhausting—is almost certain to wear out the patient. When the tumour is small, the incision for its removal is made through the integuments and superimposed glandular substance, so as to expose the mass, which is then laid hold of and dissected out of the capsule, but loosely adherent to its surface. The bleeding from the mammary vessels is usually copious and troublesome. When the tumour is of large size, and the mamma has become completely atrophied, the entire mass should be removed as a whole, the gland having generally become incorporated with the tumour. *Cystic sarcoma* is very common. Like the simple mammary tumour, it is most frequent under thirty years of age, and prevails chiefly among the better classes. It is composed mainly of serous cysts, the parenchyma consisting of little more than the substance of the gland

slightly altered. And there is some reason to believe that these cysts may sometimes originate in partial lacteal dilatation. The existence of a cystic element in such a tumour is rendered probable, by the irregular outline of the swelling, the more or less perfect sense of fluctuation experienced at the most prominent parts, and sometimes by the bluish translucency of the skin where tensely stretched. When the cysts are simple, serous, and uncomplicated by any suspicious solid structure, by puncturing the sac, and afterwards applying a blister, or injecting iodine, the tumour may diminish, consolidate, and gradually disappear. But when the whole gland is involved, especially if the growth is painful and large, extirpation should be at once had recourse to; not only because other treatment will prove unsuccessful, but because such tumours are well known to be peculiarly prone to develop malignant characters, more especially when irritated. *True Hydatids* are also found in the gland. When single, they may be got rid of by puncture and injection. When numerous, ablation of the part is expedient. *The Malignant Tumours* of the mamma are unfortunately of proverbial frequency; more especially carcinoma or scirrhus. The general characters of this tumour are not departed from; the chief peculiarity being in the nipple, which, early involved, is remarkably retracted, hardened, and shrivelled in appearance. The glands of the axilla, too, are liable to be soon affected. The disease is recognised by the age of the patient, usually between forty and fifty; by the hardness of the tumour, like cartilage or wood; by the lancinating character of the pain, the rate and mode of growth, the involvement of the skin and retraction of the nipple, the implication of the pectoral muscle and axilla, and the cachectic state of the system as evidenced by the countenance and general appearance. The only cure is by extirpation; but it is only a small number, of the many cases which present themselves to the surgeon, which warrant operation; and it may be well to repeat here, that if the skin be diffusely brawny, or so much involved that it cannot be wholly removed, if the nipple be much retracted, if there be a marked depression over the tumour, indicating usually adhesion of this to the pectoral muscle or to the ribs, if the pulse is persistently above 100, if there be complaint of general rheumatic pains, or if other ominous signs exist of some obscure yet serious disorder proceeding within, and if there be glands so affected and attached that they cannot be taken away—these, being all singly most unfavourable, and betokening relapse, do most certainly, when coming together, contra-indicate all operative interference.

There are cases, however, where, although the prognosis is unfavourable, the operation may be undertaken; as, for example, when the glands are affected, but only those close to the margin of the tumour, and quite within reach;—or when the cancer is in the open condition, but the glands as yet unaffected. Also, when the horribly foetid ichorous discharge and the severe pain of an advanced and hopeless cancer make the patient's life perfectly unsupportable, while the general strength continues good, if the patient demands the possible relief which operation may afford, in preference to the miserable progress of the disease, if left alone, the practitioner is quite justified in resorting to operative inter-

ference. The really satisfactory cases for operation are those which occur in women about fifty years of age, when the disease is traceable to injury, when its progress has been and is slow, when there is no glandular or pectoral implication, and when the patient has a tolerably healthy appearance. In aged patients suffering from the atrophic form of scirrhus, there is no propriety in resorting to operation, as the progress of that affection is not likely materially to shorten their days.

The Medullary Tumour of the Breast is, as an original affection, less common than scirrhus, but frequently constitutes the form of cancer assumed in those cases where the disease is reproduced after the removal of scirrhus. It may appear at any age after puberty, but most commonly occurs in patients in middle life. The characters of the tumour are found in its soft elastic consistence, and in its irregular form, with more or less discoloration of the skin at the most prominent parts—presenting a reddish or brownish tint, due to a great increase in its capillary vascularity, with large veins coursing beneath the skin, particularly towards its axillary margin. The pain varies in different cases, and in the same case at different periods of its progress. As the disease advances, the patient becomes sickly in aspect, of a chlorotic hue, and presents a peculiar, languid, care-worn expression. Locally, the tumour tends to involve the subjacent muscles, the walls of the chest, and the axillary glands; while the skin first becomes adherent over the prominent part of the mass, and then ulcerates, while from the opening so formed the softened morbid structure protrudes in the form of a fungus, from which a copious, thin, ichorous, and foetid discharge is constantly rendered. Bleeding in considerable quantity also ensues from time to time, and is with difficulty arrested by pressure and the application of matico. As the skin gives way, the masses of the morbid structure which protrude slough, and separate; for a time the tumour may seem to have almost enucleated itself; but this illusory appearance of amendment is very speedily followed by fresh growth and further extension of the disease. The disease progresses most rapidly in young subjects. In middle life, so long as the tumour is occult, the skin unimplicated, and the diseased part carefully protected from injury, months or years may elapse before it terminates fatally; but so soon as the open condition is reached, and the morbid structure commences to fungate and bleed, the fatal issue cannot be long delayed.

If operations for scirrhus of the breast are for the most part followed by such unsatisfactory results as to lead to a careful selection of cases in which to recommend excision, still more must operative procedure be regarded as exceptional in cases of medullary disease. Any partial removal of the tumour will only make matters worse, by hurrying on the fatal progress of the disease; and a diffuse tumour, ill-defined cutaneous involvement, thickening in the axilla, enlargement of the lymphatics, a youthful patient, and rapid growth—plainly indicate that no operation should be attempted. When, also, the subjacent muscles are involved, when the open condition of the disease is attained, and the patient has a rapid pulse and a cachectic look, the operation, unless to relieve pain, or to prevent death from hemorrhage, or to remove the horrible foetor which makes the patient's existence a burden to her, is

certainly interdicted. If, however, the tumour be distinctly limited, of unusually firm consistence, and of slow progress, occurring in an otherwise apparently healthy patient beyond mid-age, there is good ground for urging the operation, as the only possible means of preventing the otherwise certainly fatal progress already described.

Extirpation of the Mamma.

The patient having been placed recumbent, and chloroform administered, the arm on the affected side is raised and held by an assistant, so as to stretch the pectoralis major, and facilitate incision and dissection. Two curved incisions are then made in the axis of the pectoral muscle, including the nipple and involved skin ; and both extremities of the elliptical portion of the integument, thus mapped out, should extend beyond the confines of the gland. The size of this space necessarily varies, according to the extent to which the integument seems to be involved, and according to the natural laxity of the parts. It is a fault to take away an undue amount of soft textures, so that difficulty is experienced in effecting and maintaining apposition of the wound ; but it is a worse error to leave tainted parts, whereby reproduction of the disease cannot fail speedily to ensue. In some rare cases, peculiar circumstances may render an incision in the opposite direction better suited for the removal of the tumour and diseased integument, or more satisfactory in the apposition of the line of wound. It is well to make the lower incision first ; otherwise its course and position are apt to be uncertain, under the flow of blood. First on the axillary, and then on the pectoral aspect, the knife is carried through the subcutaneous fat, between the skin and the surface of the gland ; the cutaneous textures being dissected back in the form of flaps, till the whole of the anterior surface of the gland is completely disclosed. This must be done carefully, especially in the neighbourhood of the diseased part—and in clearing the thin margins of the gland over the pectoral muscle—else some portion of its structure is apt to elude the knife, and be left behind to constitute a nidus for reproduction of the disease. Any vessels which spring during this part of the operation should be compressed by the fingers of assistants ; unless when loss of blood would be attended by risk ; and then they may be tied as divided. Generally it is recommended to proceed with the removal of the exposed gland from the axilla downwards ; thus dividing the principal vessels and nerves at once, and so rendering the subsequent steps of the operation comparatively bloodless and free from pain ; but while there can be no objection to this in most cases, yet when any glandular enlargement exists, it may be well to leave the axillary connection to the last, so as more readily to effect removal of the adjacent glands along with the tumour. The diseased mass having been cut out, is carefully examined on every aspect by both sight and touch ; and, if need be, the knife is re-employed where thorough removal is not assuredly apparent. The vessels having been secured by ligature, the wound is brought together by wire sutures ; and pads of lint having been laid along the margins of the incision, so as to support the flaps of integument in steady contact with the subjacent parts, they are retained

by strips of adhesive plaster, by a folded towel, by a handkerchief, or by a single turn of a bandage pinned across the chest. The wound is afterwards to be treated in the ordinary way ; the arm being kept close to the side, and perfectly still during the progress of cicatrization.

Affections of the Mammilla.

The Mammilla of the male is liable to hypertrophy and to malignant disease. In the one case, discussives are expedient ; the other demands free and early ablation. Also, when hypertrophy is advancing, is attended with neuralgic pain, and creates anxiety in the mind of the patient, the enlarged gland should be removed. One or both glands may be thus affected, and require attention.

The nipple of the female is also liable to hypertrophy, and malignant disease. In the former case no direct interference is required ; in the other, there is safety in nothing short of summary removal—not only of the nipple itself, but of the mamma also. There is one case, however, in which it is unnecessary to sacrifice more than the former ;—when the nipple has been hypertrophied many years, and begins to degenerate in structure. Such degeneration usually commences in, and is at first limited to, the apex ; and, in such a case, to cut at the root of the nipple is to cut in sound parts.

The fissured and excoriated nipple during lactation is an affection as frequent as distressing. A bare enumeration of “infallible cures” would occupy much space. Suffice it here to say that the same treatment is necessary as in inflamed and irritable sores, modified by regard to the uses of the part. During application of the child, the nipple is guarded by a shield ; and in the interval, while the nipple is protected from undue pressure of the dress—a gutta percha shield, half an inch in thickness, with a suitable central aperture, being best suited for this purpose—some of the many remedies are applied, which are not likely to injure the child, while at the same time they tend to soothe and heal the affected part ;—of these, an ointment composed of wax, almond oil, and Peruvian balsam, being probably as good as any other. In the slighter cases, brandy and lime-water will be found a satisfactory application, used each time the child is removed.

CHAPTER LIV.

AFFECTIONS OF THE ABDOMEN.

Tumours of the Abdominal Parietes.

THESE demand early attention, lest, by long continuance and enlargement, they become unfavourably connected with the deepest portion of the parietal layers. The adipose is, perhaps, more common than any other form of tumour in this situation. In dissecting it out, the preliminary incisions should penetrate quite into the substance of the fatty matter; thereby facilitating extraction, and avoiding unnecessary depth and extent of incision.

Bruise of the Abdomen.

Contusions of the abdominal parietes, without rupture of any of the viscera contained in the cavity, may prove serious, especially when affecting the epigastric region; as the sudden shock inflicted on the solar ganglion may induce fatal syncope, and still leave no trace behind in post-mortem examination. A remote consequence of bruise of the abdominal parietes may be such weakening of the muscles at the injured part, as to permit bulging there, even amounting sometimes to hernial protrusion. In all cases, contusion of this part should be regarded as important, when shock is present; on account of the possible occurrence of injury to the abdominal contents, the existence of which time alone can determine. The risks of contusion affecting the abdominal contents are threefold:—1st. Fatal shock. 2d. Laceration of internal parts or organs, with internal hemorrhage, or extravasation of irritating secretions into the peritoneal cavity. 3d. Peritonitis. (1.) The shock rarely proves immediately fatal, except in the injuries to the solar ganglion; and even such a cause of instant death has been denied by some authors. When extravasation of the contents of the gall bladder, intestines, or urinary bladder occurs into the peritoneal sac, the symptoms present are: intense burning pain affecting the abdomen—both generally, and specially in the site of the lesion; the features become shrunk and death-like, the surface is covered with a cold clammy perspiration, the pulse grows small and frequent, the voice is broken and child-like, the patient complains of insatiable thirst, and vomiting of stuff resembling coffee-grounds frequently sets in before the fatal termination. In such cases, the patient rarely survives for two days; and while he may die within a few hours, he usually lives for about twenty-four hours after the accident. If life is prolonged for a day or two, the shock probably passes off; and symp-

toms of peritonitis may have manifestly set in, or at least its morbid appearances are discovered after death. It is not easy to account for the rapidly fatal issue from shock, except by supposing it due to poisoning of the system by the rapid absorption of the extravasated fluids. (2.) The hemorrhage rarely produces a fatal result until the shock of injury begins to pass away. Its source may either be from the vessels of the parietes, or, more usually, from the vessels of a ruptured liver or spleen. On dissection, the blood is found both as a thin layer of coagulum forming a mould of the neighbouring viscera over which it is spread, and also in the form of a dense firm cake in immediate contact with, and occupying, the laceration of the injured organ. The signs of hemorrhage are those characteristic of excessive loss of blood, with a sense of abdominal oppression, and even in some cases of fluctuation perceptible on external examination. The only chance for the patient suffering from such contusion of the abdominal organs, must obviously consist in permitting the state of shock, or depression of the system, to continue for a time. And this must be well borne in mind ; as a very common and not unnatural error in practice is, at once to attempt removal of it. The same evil consequences follow, as in the analogous case of injury done to the cranial contents. Let the patient alone ; and ere reaction occurs, with its quickened and full circulation, a torn liver or spleen may have had its vessels closed by Nature's hemostatics ; and a ruptured portion of intestine may be so circumstanced by position and circumscription of the injury, should it not have been distended at the time of the accident, as to render fatal escape of its contents into the peritoneal cavity at least less probable. But, stimulate unwisely ; and then premature reaction is established ; the returning blood finds the mouths of vessels still open, and intestinal extravasation is quite unopposed. In one case, only, are we to interfere ; and that is, when the shock is extreme in both intensity and duration, and threatens to prove directly fatal. Then we stimulate, to save life from immediate loss ; and yet we stimulate very cautiously, lest saving from one hazard we engender another at least as great. In treatment, all these contingencies must be regarded. In all cases, absolute rest and quietude are enjoined ; and the simplest ingesta, such as ice, milk, and the essence of beef, are given most sparingly. (3.) Symptoms of peritonitis usually manifest themselves, if they are to occur, within the first twenty-four hours, and are indicated at their commencement by frequency and hardness of pulse, by anxiety of the expression, by arrest of all diaphragmatic breathing, by the position of the patient, lying upon his back with his limbs drawn up, and by tenderness upon pressure of the abdomen. On the first rising of the pulse beyond the limits of moderate reaction, leeching should be freely employed, followed by hot fomentation, and calomel and opium internally. And here the opiates may be administered in a larger proportion than usual ; it being the only available opponent of the intense and exhausting pain which attends on such disease—as well as being besides of great service, in injuries of the intestines more especially, by exerting a sedative effect on the muscular coat of the bowels. Very obviously, purging is not to be dreamt of, in the early treatment. Subsequently, when it is necessary to move the bowels, the gentlest remedies are to be selected ; and even they are used with caution.

Wounds of the Abdomen.

Wounds of the Parietes of the Abdomen, which do not penetrate into the sac of the peritoneum, are for the most part formidable only from the risk of involvement of the subjacent serous membrane during the occurrence of the inflammatory access, and of weakening of the wall after healing of the wound. In the diagnosis it is a matter of difficulty, often, to decide whether the cavity of the peritoneum is wounded or not—all the more that probing must on no account be permitted; the non-existence of shock, and of intestinal protrusion, leads usually to the inference that the cavity is not implicated. In any case, however, it is well to err upon the safe side, and insist upon complete repose. In treating such wounds, the patient should lie upon his back, with the limbs and trunk flexed by a pillow placed beneath the thighs, so as to keep the knees bent, and with several pillows so arranged as to support the back, neck, and head. A broad binder should also be carried round the abdomen, and secured with pins, so as to resist respiratory movement, and prevent, as far as possible, all tendency to bulging at the seat of injury.

Wounds penetrating the Abdominal Parietes, and implicating the viscera within, are necessarily fraught with much danger. From lesion of the liver or spleen, a formidable hemorrhage can hardly fail to occur; wound of the urinary bladder, gall bladder, or intestines, causes effusion of the contents, almost invariably fatal—from shock, or from the effects of absorption, or at a later period from intense peritonitis. In wound of the kidneys, both acrid extravasation and dangerous loss of blood are likely to follow. Such severe injuries are invariably attended with a grave amount of shock, which serves to warn the attendant of the importance of the case, and affords an opportunity for the completion of Nature's measures for obviating hemorrhage and extravasation. This state, as formerly observed, is not to be rashly interfered with by the practitioner; its progress is watched; reaction is rather delayed than hastened; and when this, no longer repressible, advances to excess, antiphlogistics are employed actively.

Wounds of the Intestines may be suspected when blood is vomited or passed at stool, accompanied by shock; and this suspicion becomes a certainty when symptoms of effusion into the abdominal cavity are superadded, and still more when purulent, biliary, or urinous fluid, as the case may be, passes from the wound. Such effusion in the case of wound of the intestines does not, however, necessarily take place. A mere puncture is closed by Nature's efforts. The mucous coat is protruded outwards, and plugs the orifice; the abdominal viscera exert a constant equable pressure on each other at every point, and this tends obviously to counteract escape of contents; and these two temporary means of arrest are duly followed by another which is permanent—namely, formation of plastic product on the exterior of the wound, whereby it is sealed, and the bowel at the site of injury united to the opposed peritoneal surface. A moment's consideration of the nature of this process will explain how mischievous must be the imprudent exhibition of stimuli, or indeed of ingesta of any kind, at the outset of the treatment.

In any case, however, where the wounded bowel is distended with fluid fæculence at the time of the injury, and especially if the wound extends in the length of the intestine, or divides the bowel throughout a considerable extent of its circumference, a fatal result can scarcely be averted.

Protrusion of the Bowel.—If through a penetrating parietal wound a portion of intestine, or other viscus, protrudes entire, it is to be simply replaced; with all gentleness, so as not to endanger an aggravation of inflammatory accession; and yet with all accuracy—the finger following the retreating viscus closely, so as to ensure its being replaced wholly within the abdominal cavity—thus avoiding the serious risk of obscure strangulation, which is so prone to follow partial reduction. The wound is carefully approximated—by suture, if need be; and by moderate bandaging such pressure is made without, as is calculated to prevent reprotrusion. In subsequent treatment an anxious prophylaxis is maintained, with a preparation for suitable antiphlogistics on the shortest notice.

If the protruded part be found to have sustained mere puncture, it may be simply replaced, as if intact; trusting to Nature's means of closure. If a larger wound exist—incised, of no great extent, and consequently deemed capable of adhesion—it is to be brought accurately together by the glovers' suture. And, in applying this, it is well to turn in the edges of the wounded part gently, so that the approximated surfaces shall be peritoneal; that structure being well known to be much more capable of the required plastic process, than are the mucous or middle coats of the bowel. The punctures of the needle should not be more than a line apart; and the fingers of an assistant should accurately retain the inverted condition of the wound during the manipulation. It is well to take the first stitch from within outwards; and the placing of a large knot here is supposed to favour the inward escape of the thread; which in time ulcerates its way into the cavity of the bowel, and is thence discharged. The suture having been duly arranged, the part is gently replaced; in the hope that it may become safely covered up by plastic product. (Fig. 203, p. 476.)

If the portion of bowel be bruised, or otherwise so extensively injured as to render the occurrence of adhesion obviously impossible, it were folly to effect mechanical union and replacement of the part; except, indeed, when the bruising or laceration is so limited, as to admit of its being easily removed by paring the edges of the wound before introducing sutures. When the laceration and contusion are to such an extent that the wound must necessarily inflame and open, were the intestine returned into the cavity of the abdomen fæculent extravasation would be inevitable, and death would be almost certain. The wounded part should, therefore, be retained at the surface; and, with this view, the peritoneal coat is united with the integument, at the lip of the wound, at one or more points by suture; and then through the upper orifice of the wounded part the fæculent contents discharge themselves innocuously. The condition of *Artificial Anus* is established; a state of much discomfort, and by no means devoid of danger; but infinitely less fatal than fæculent escape into the cavity of the abdomen.

Thus, the local treatment differs according to the nature of each case.

But in all, the constitutional treatment is the same : rest and quietude ; starvation, and the non-employment of purgatives ; free venesection or leeching, or both, on the first onset of the inflammatory process ; then calomel and opium—the latter in large doses.

Abscess of the Abdominal Parietes.

Abscess of the abdominal parietes sometimes occurs spontaneously ; frequently, it is the result of external injury ; and, in some systems, a slight blow, rupture of some of the fibres of the muscular structures of the abdominal wall, or a strain, as in retching, may suffice for its production. The original site of the abscess, however, is more frequently deep-seated than superficial ; commencing, as it often does, in the right iliac fossa, from some irritation in the *caput cæcum coli*, which has produced a *perityphlitis*, terminating in suppuration. The matter, when formed, may make its way to the surface above Poupart's ligament ; or it may work down the inguinal canal along the cord, and point at the external abdominal ring ; or, pushing the peritoneum before it, it may ascend as far as the outer margin of the rectus, there perforating the layers of the abdominal wall, below the posterior sheath of the muscle, becoming superficially diffuse, and usually pointing at or beside the umbilicus. At first there is a hard, tender, increasing tumour, which softens obscurely as it enlarges, and slowly points. Treatment varies according to the stage. At first, while the inflammatory process is but recent and slight, and the swelling consists of plastic product, resolution is in our power ; by rest, leeching, warm fomentation, counter-irritation, and mercurials. Advancement of the tumour is arrested, and the hard swelling begins to disappear. This subsidence may be accelerated by judiciously used discussives—employed, however, always with the greatest caution, inasmuch as we know by experience that if they be used either too freely or too soon, there is a great probability of inflammatory reaccession, in an aggravated form. So soon as the formation of matter has been at all indicated, a free evacuating incision should not be delayed ; it being remembered that the pus is much nearer to the peritoneum than to the integument, and moreover bound down by strata of dense fibrous and muscular tissues. But it is surely advisable to go a step further, and, whenever we feel convinced that reasonable hope of arrest and resolution is gone, to make an incision in the most prominent part of the swelling, where we anticipate that matter is first and mainly to be, in order that so soon as it does form it may find a ready drain for its outward escape ; all the hazards of its pent-up accumulation, in any quantity, being thereby felicitously avoided. If artificial opening be withheld, one of two events is very likely to occur ; the pus, finding its way into the general cavity of the abdomen, excites peritonitis ; or, on spontaneous evacuation taking place, the condition of faecal fistula is established—the perforation internally, surrounded by plastic formation, having penetrated into an adherent fold of intestine, or directly into the cæcum.

As already stated, lumbrici, cherry-stones, the bones of small animals or birds, and such like substances, may be arrested in the caput

cæcum, or vermiform process, and, acting as an exciting cause of abscess, effect their own escape.

Artificial Anus.

By this term is meant an unnatural outward opening of the intestinal canal, whence fecal contents are more or less copiously discharged. It may be the result of wound, of abscess and ulceration, or of sloughing consequent on strangulated hernia. By plastic product the open portion of bowel is retained in contact with the abdominal parietes; and the following condition of parts becomes established. The orifice of the upper or gastric portion remains abundantly patent, and not unfrequently troublesome prolapsus of its lining membrane occurs; the orifice of the lower or rectal portion contracts, is not patulous, and recedes from the external surface; the two portions have a dense septum interposed between them—composed mainly of the two contiguous portions of the coats of the bowel; and this becomes more and more solid, and more and more opposed to restoration of the normal flow of the intestinal contents. Outwardly the abdominal parietes are usually distended into a funnel-shaped cavity, whose apex is at the integument, whose base surrounds the intestinal breach, and within whose cavity fæculent matter tends to accumulate. The integumental opening is red, everted, prominent, and surrounded by excoriation.

The dangers and difficulties of such cases depend very much on the site and extent of the intestinal opening. If this be large and near the upper part of the tube, death by inanition can scarcely fail to occur; chyle running so much to waste. If, on the contrary, the opening be in the large bowel, nutrition may be sufficiently maintained, and the result will probably be one more of annoyance than of danger.

Treatment is in the first instance palliative. Such food is taken as is easily digested; and the bowels, by diet, and medicine, if need be, are kept “soft and easy.” By external support—by compress and bandage, or by the adaptation of a suitable truss—outward escape from the upper orifice is moderated, if not altogether prevented, and protrusion of the mucous membrane is opposed. And the ordinary means are employed, to obviate excoriation of the surrounding integument. The outer opening may contract and heal, the funnel-shaped cavity may close, and the normal flow may be restored. But much more frequently such is not the case; and further interference by our art is required. The two main obstacles to cure plainly are—projection of the septum, and retraction and contraction of the lower intestinal orifice. The latter state is to be opposed by the occasional introduction of tubes or tents, gradually enlarged, whereby the normal calibre may be restored. The septum is to be got rid of, by the gradual process of ulceration. Physic of New York first suggested the accomplishment of this, by a stout ligature passed by means of a needle through the textures of the *eperon* of the septum. Dupuytren’s forceps may, however, be employed more safely for this purpose;—one blade passed into each orifice, the instrument closed and locked, the one blade accurately fitting into a groove in the other, while the degree of pressure is regulated by the screw at the handle. The pressure is at first applied lightly and temporarily; lest excess of the

inflammatory process ensue, and the surrounding parts be implicated so as to establish either enteritis or peritonitis. And throughout the whole period of the instrument's use, the effects must be closely watched, lest at any time such accidents threaten to occur. By thus gradually dividing the septum—inducing ulceration of it by pressure, and regulating that pressure so that the inflammatory process it creates shall not go beyond ulceration in the part, nor extend thence to the neighbouring textures—by dilating and bringing forward the lower orifice, and by maintaining the external pressure at all times when the forceps and tent are not in use, we hope to restore the normal flow, and effect permanent closure of the aperture. But not only must this use of the forceps be cautiously conducted; it must also be warily begun. Weeks or even months should elapse before it is employed. For, an early application is plainly in favour of the occurrence of the following risks: a fold of bowel interposed between the two orifices, on account of the septum not being yet fully developed, may be grasped by the instrument, and fatal enteritis may ensue; or the yet recent, tender, and imperfect adhesions of the bowel to the parietes may be broken up, the former may recede, fæculent extravasation then takes place, and life is soon ended miserably by peritonitis; or, simply on account of the still unquiet parts having no tolerance of a newly-excited inflammatory process, immature use of the forceps may be speedily followed by enteritis; or the pressure may cause ulceration of an asthenic kind—not attended by plastic product around—the abdominal cavity may consequently become exposed, and fæculent extravasation into it may occur.

The projecting septum, or *eperon*, may be repressed simply by the pressure of tents; or the compressing forceps of Blandin, or the ingenious though somewhat complicated instrument of Mr. Trant,* may be used instead of that of Dupuytren. Such pressure, causing replacement and absorption of the projecting obstacle, is obviously more safe than that which produces destructive ulceration.

An artificial anus is sometimes established, designedly, by the surgeon; when the natural anus is imperforate; or when, from any cause, the rectum has become insuperably obstructed. These proceedings will be considered in connection with affections of the lower bowel.

Fæcal Fistula.

When an artificial anus has contracted to a narrow sinus, with a papillary orifice through which intestinal contents occasionally escape, it is termed a Fæcal Fistula.

A similar state may also result from parietal abscess; whose cavity has opened, by ulceration, into a portion of adherent bowel, either before or after external evacuation. The opening of communication is usually small; the cavity of the abscess contracts; and the condition of fistula is soon established.

The methods of treatment are simple. Accurate and firm pressure is applied to the part, so as to prevent fæculent escape, and favour con-

* Dublin Med. Press, vol. xiii. p. 305; and Brit. and For. Med. Chir. Rev., Jan. 1847, p. 28.

solidation of the entire track. This may succeed, after patient continuance of it for some time, along with complete repose in the recumbent posture, a limitation of diet almost approaching to starvation, and due attention to the state of the bowels. If it fail, then the actual cautery may be applied, so as by contraction of the burn to obtain closure. And if this do not succeed, then by autoplasty the chasm may be filled up and permanently consolidated; a suitable portion of integument being transplanted from a neighbouring part.

Pelvic Abscess.

The sub-peritoneal areolar tissue, in the pelvic region, is liable to be the seat of suppurative inflammatory disease; sometimes in connection with the puerperal state, but often wholly independent of this. Occasionally it is induced, on the right side, by irritation extended from the caput cœcum—forming the *perityphlitis* of Burns and others; on the left side, it may originate in impaction or other disorder of the lower bowel. It has followed operative interference with the uterus or its appendages—as well as with the penis and bladder—not unfrequently; sometimes it is traced by the patient to a chill; sometimes it can be connected with no assignable cause. The disease is more frequent in the female than in the male. Inflammatory product is usually rapid and copious; and at first is either serous or fibrinous. In this state it is amenable to absorption; and under suitable treatment may disappear rapidly. When suppuration has fairly taken place, evacuation is to be looked for, either spontaneously or by the hand of the surgeon. In the former case, the point of exit varies; at the hypogastrium, or umbilicus, by pointing in the ordinary way; in the groin; by the bowel; through the upper wall of the vagina, close to the anterior lip of the cervix uteri; into the bladder; or into the general abdominal cavity. Fortunately, the last-mentioned casualty is comparatively rare; the peritoneum, from its fibrous nature, long resisting the ulcerative tendency of the accumulating pus. Sometimes, instead of suppurating, the tissue becomes loaded with a dense plasma, partially incorporated and organized.

The symptoms are usually ushered in by rigor. There are pain and tenderness of the part, with dulness on percussion. The rectum and bladder, being compressed, and involved in sympathy, have their functions more or less disturbed; and the uterus, too, is liable to displacement. On examining by the vagina or rectum, a hard dense swelling is perceived; determined to be non-uterine, if need be, by the use of the sound; and, unlike other pelvic swellings, having very firm connection and continuity with the bony walls of the pelvis. In doubt, an exploratory thrust may be made by the small trocar—through the abdominal parietes, by the vagina, or by the rectum, according as the site of the swelling may determine. On outward pointing taking place, the nature of the case becomes abundantly plain.

At an early period, the treatment consists of leeching, followed by counter-irritation, and mercury pushed to ptyalism. Iodine may be painted over the abdominal parietes; or it may be administered in the form of ointment, by the vagina. Under such remedies, with rest, and

attention to the general health, many formidable accumulations satisfactorily disappear ; perhaps leading an inexperienced observer to suppose that an ovarian or other tumour has been discussed. When matter has formed, it should be early evacuated, by means of the bistoury or trocar, at the point which circumstances may indicate as most suitable ; by the vagina, by the rectum, or through the abdominal walls.

Retro-uterine Sanguineous Tumours.

There is another class of swellings in this situation, which may be mistaken for the inflammatory pelvic tumour, in the female. They are caused by extravasation of blood into the sub-peritoneal areolar tissue of the *cul de sac* between the uterus and rectum ; and in their pathology resemble the thrombus, which is not unfrequently found situated in the vagina or vulva. The affection may, in fact, be described as a thrombus of the roof of the vagina.

The blood is infiltrated into the areolar tissue, around the cervix uteri, and may spread thence into the areolar tissue surrounding the rectum, or into that involved between the folds of the broad ligaments. These tumours are liable to occur chiefly in cases where there is much venous congestion, and especially if there is a varicose and diseased condition of the vessels. They are caused by powerful straining efforts, as in labour, venereal excesses, etc. They may also, as M. Huguier points out, be produced by escape of blood from the uterus when over-distended by retained menstrual secretion.

On examination, the roof of the vagina will present a hard resisting surface, without pain on pressure ; or, if recent, tender to the touch in a much less degree than the real inflammatory pelvic tumour. The uterus will be found generally somewhat elevated, and pressed to the pubes.

If they are small, these tumours require no special treatment. Rest in the recumbent position, and the antiphlogistic regimen, are necessary as precautionary measures. If the extravasation is very extensive, there will be constitutional disturbance ; and local excitement may be produced, perhaps terminating even in suppuration. In this case treatment must be conducted as in the common inflammatory pelvic tumour. The evacuating incision should be free ; and the putrescent state of the interior of the sac, which usually occurs, should be corrected by frequent cleansing of the interior by injecting tepid water, and dilute solution of permanganate of potash.

Ovarian Dropsy and Tumours.

Of abdominal growths, the ovarian are those which most attract the attention of the surgeon. Occasionally fibrous tumours, or masses of the different forms of the ordinary malignant tumours, are found affecting the ovary, either alone or in combination with the cystic disease of the organ—which latter affection far surpasses all others in the frequency of its occurrence, and is generally known as *ovarian dropsy*. These cystic tumours are multilocular more frequently than monolocular. They may occur only on one side, or on both at the same time ; they may be attached by

a narrow pedicle to the broad ligament, or by a broad base ; they may be movable, or fixed in the cavity of the abdomen—this generally depending on their size, which varies extremely ; they may be free, or more or less adherent to the surrounding organs, or connected with the abdominal walls. On dissection, the ovary of the affected side may be undiscoverable ; or it may be either entire, or partly incorporated with the tumour. The disease is believed by numerous pathologists always to originate in the Graafian vesicles ; and there is good reason to attribute certain of these productions to this source ; but it is equally well ascertained that the multilocular formation does not always acknowledge such an origin.

The disease may affect a woman at any time of her menstrual life ; and is found occurring most frequently at that period when the reproductive functions are in greatest activity—namely, between the ages of twenty and forty. It attacks the virgin as well as the married woman ; but is found more frequently in the married than in the unmarried. There is no evidence for a common statement of authors that the latter are more liable to it than the former.

Many causes connected with menstruation, marriage, and parturition, have been assigned to ovarian dropsy, but this part of the history of the disease is necessarily very difficult of investigation. These affections may be mere antecedents, and not causes.

The disease may attain a large development, without giving rise to any symptoms except such as are referrible to the displacements effected by its bulk. It may be accompanied by irregularity of the menstrual function, by menorrhagia, or by amenorrhœa. At its commencement there may be much complaint of pain and tenderness in either side, or a deep-seated pelvic pain may exist, or there may be other modifications of pain and tenderness too varied to demand description. The tumour may press on the sacral nerves, and cause numbness and a feeling of powerlessness in one limb ; or venous congestion and œdema of it, by obstructing the circulation. There may be pain and difficulty in defæcation. Piles, and a varicose state of the veins of the legs, are often found. In diagnosis, our reliance must be placed almost entirely on the physical signs. Much obscurity is often produced by distension of the abdomen, with flatulence, when the disease is in an early stage ; and the evidence of its nature is derived chiefly from the circumstances of its position, its mobility, or its connections. At a later period, when it is distending the abdominal walls, we trust to its own physical characters, the nature of its contents, and the history of its origin and progress.

Careful manipulation usually shews the swelling not to be so uniform or soft as in ascites, but more or less broken up in its outline, as well as of various hardness. Attention is also given to the following points :—In ascites, the fluid always occupies the most dependent parts, while the small intestines, floated by their contained air, correspond generally to the umbilical region ; and the arch of the colon and the stomach occupy the epigastrium. Percussion, therefore, elicits a dull sound over the hypogastric and lumbar regions, and a clear one in the umbilical and gastric ; whereas, in a large encysted dropsy, no tympanitic sound exists in these regions. The intestines, pushed back by the cyst which is de-

veloped anteriorly, may, however, produce a resonance laterally and posteriorly. Fluctuation is generally more easily and distinctly detected in ascites. If the ovarian fluid is of great viscosity, or if the anterior cysts of the mass are numerous and small, fluctuation may be scarcely perceptible; while, on the other hand, if the disease be monolocular, fluctuation may be very apparent. Sometimes, in the multilocular variety, the larger cysts can be made out separately by the facility and distinctness of the fluctuation, when both hands are over the same cyst; and by its indistinctness or absence when one hand is on one cyst, and the other on a different one. In encysted dropsy, the general health is often, in the early stage of the disease, comparatively undisturbed, while in ascites the reverse is almost always found to be the case. Along with ascites, there is generally anasarca of the lower extremities, while in ovarian dropsy this is rarely observed. In the latter affection, however, we frequently find a varicose state of the vessels, and puffiness of the limbs. It is also to be remembered that ascites and ovarian disease frequently co-exist; the ascitic fluid being of the ordinary kind; or derived from an ovarian cyst by passing through foramina in its walls. When these diseases co-exist, fluctuation, if light and superficial, may deceive; but if the fingers are pressed more deeply, a peculiar diagnostic mark is obtained by the stroke of the fingers against the ovarian cyst—after displacing the overlying ascitic effusion. If there is still doubt, we may in some cases be justified in drawing off a few drops of the fluid by a small trocar, and ascertaining its nature by proper tests.

Dulness on percussion over the hypogastric regions is more decided in ovarian dropsy than in ascites. If, however, the pedicle be long, and the tumour only moderately large and not distending the abdominal walls, but rather floating in the cavity, there may be some resonance above the pubes. In some rare cases this mark is of importance, in distinguishing the ovarian dropsy from pregnancy;—in both cases we may find on auscultation a murmur resembling the placental *soufflé*; and in ovarian disease, especially if recent, the equivocal signs of pregnancy may be present. From pregnancy it is further distinguished by absence of the sound of the foetal heart, by the absence of ballottement,* by the drawing up of the uterus and vagina so that the cervix is with difficulty reached, by the hardness and length of the cervix, by the anteverted or retroverted state of the organ, by the commencement of the disease on one side, by more or less complete absence of the ordinary constitutional signs of the pregnant state, and by the duration and history of the complaint. Let the surgeon, however, never forget that with ovarian disease (at least of one side) there may co-exist an impregnated womb; and that in one case, at all events, the pregnant uterus has been tapped, under the supposition that it was an ovarian tumour, with the sanction of no less than three eminent accoucheurs.

There is occasionally great difficulty in distinguishing a multilocular ovarian dropsy from fibrous or other tumour of the uterus. The tension of the cysts, their small size, and the viscosity of their contents, may be such as to destroy all signs of fluidity in the ovarian mass; and the

* A modified ballottement may be discovered in a case of ovarian tumour, if it is of moderate size and floating in ascitic fluid.

uterus may be so fixed in the pelvis by compression between it and the tumour, or by adhesions, as to render the signs derivable from a vaginal examination also nugatory. The history of ovariectomy too truly shows that the diseases may be mistaken for one another, even by the most experienced and able physicians. The chief distinctive marks are the following:—A fibrous tumour is often observed first in the centre of the hypogastrium—an ovarian tumour generally at one side; a fibrous tumour grows more slowly than an ovarian; it has no fluctuation, and is generally harder and much less movable than a diseased ovary; it is more frequently accompanied by menorrhagia and leucorrhœa; the uterus is generally somewhat prolapsed, especially if the tumour is not of great size; the uterus feels heavy, and cannot be moved without moving the tumour; the cavity of the uterus is also often elongated; sometimes it is shortened; frequently the shape and plurality of the tumours are distinctive.

In illustration and proof of the great difficulties which attend the diagnosis of ovarian disease, and of the errors liable to be made, even when the growth is so developed as to appear to demand an operation, we may cite the following fact in regard to 162 cases in which incision of the ovary was attempted. In 60 of these there was either no ovarian disease at all, or its removal was found impracticable.*

The management of ovarian dropsy is either palliative or radical. Besides the ordinary treatment for intercurrent inflammatory attacks—and for derangements of the functions of the stomach, bowels, kidneys, and bladder—the most important palliative measures are tapping and pressure. Recourse to the former has been recommended early in this affection; but it is a very questionable proceeding, and one, besides, which we rarely have an opportunity of trying, as women seldom complain till the disease is far advanced.

Tapping is not advisable, except under rare circumstances, till the accumulation has become intolerable to the patient, from its large size impeding respiration and progression, and causing much local pain and suffering; perhaps producing vomiting, or suppression of urine, by pressure on the stomach or kidneys. It is a very simple operation, and the danger supposed to attend it in ordinary cases has probably been exaggerated, in the statistical tables of Southam, Stafford, Lee, Atlee, and others; which, embracing all cases, do no doubt include many in which it was resorted to in despair, or as a mere temporary means of alleviation—the patient's strength being already worn out by the disease, or compromised by some other affection. The dangers chiefly to be apprehended are—syncope, the lighting up of suppuration in the lining of the cyst or cysts, and the supervention of peritonitis.

It is performed thus, whether operating for ovarian dropsy or for ascites:—The patient having been seated on the side of a bed, or on a chair, has the abdomen tightly girded by a sheet or flannel bandage; the ends of which are held by two assistants, directed to pull steadily and firmly as the fluid escapes—so as to maintain equable pressure on the abdominal contents, and obviate the sudden loss of support to these, which might otherwise occur, and from which serious

* *Lancet*, Dec. 6, 1851.

hemorrhage might ensue by the giving way of one or more abdominal veins suddenly deprived of their ordinary support. Or, independently of rupture, alarming syncope might take place, from great or sudden accumulation of blood within the abdominal veins.* It is well to ascertain that the bladder is empty. An aperture having been clipped in the bandage, an incision is made through the skin and fascia by a lancet or scalpel; and then perforation is completed by a large trocar and canula. The trocar having been withdrawn, the canula remains, and through this the fluid escapes; thin and albuminous, or viscid, ropy, and variously discoloured. Fluid having ceased to come, the canula is withdrawn, the wound is covered by a compress, and the general bandage of the abdomen is drawn tightly and secured. This cure by tapping is an excellent instance of the surgeon taking a lesson from the plans sometimes adopted spontaneously by Nature. Examples of the simple cyst, and more rarely of the multilocular, have been cured by spontaneous discharge of the contained fluid from openings through the umbilicus, or some other part of the abdominal wall, or by discharge of the fluid by the vagina, rectum, or bladder.

The point usually selected for the opening is in the linea alba, about midway between the umbilicus and symphysis pubis. But it may be made in the linea semilunaris, should the bulging cyst render that locality preferable. The trocar employed for tapping may be the ordinary large-sized instrument commonly employed in cases of ascites. To avoid all risk of the sac slipping off the extremity of the canula, the long curved trocar for puncture of the bladder may be used, or an instrument may be made for the purpose from six inches to a foot in length. By some, again, the middle portion of the canula is made of gum-elastic material, so as to admit of its curving to suit the subsidence of the cyst as the fluid becomes evacuated. To avoid the entrance of air, the canula may be of twice the usual length, while the stylet is made to slide within it as a piston, the retraction of which permits the fluid to escape from the canula by a side aperture, to which a caoutchouc tube is attached of sufficient length to convey the fluid directly into the pail. A new form of trocar has recently been introduced. The stylet is a steel tube sliding within the canula, and the extremity of this tube is rendered sharp and penetrating by being sloped obliquely like a cut quill and ground to a cutting edge and point. When the sac has been entered, the inner tube is retracted, and the canula pushed onwards until that portion of it which has a series of prismatic ledges projecting from its surface has partially passed the parietes and entered the cyst, so as to secure retention of the aperture in the sac in correspondence with that of the walls of the abdomen.

By the use of pressure after tapping, the walls of the cyst are made to collapse, and the mass comes to form a comparatively small firm tumour in one side of the pelvis. When such pressure is resorted to in the hope of cure, it should be kept up for some months; as these tumours have been known to refill, after they have lain in the pelvic

* By keeping the patient horizontal on the side, during the whole period of the operation, the necessity for bandaging and pressure may sometimes be in a great measure superseded.

cavity for a long time collapsed and causing no inconvenience. The use of pressure, if it can be borne, and be regularly conducted, is decidedly of service in impeding growth of the tumour, and refilling of the sac. And some very interesting cases are recorded, where inflammatory disease, attacking the cyst and its serous investment, has induced such induration, and caused the formation of adhesions so strong, as to resist further progress of the tumour; curing the disease by mechanically arresting its progress. But the cysto-sarcomatous tumours, the fibrous, and the malignant masses, which are not unfrequently found in this situation, either alone or along with the multilocular cyst, are, of course, not amenable to any method of discussion.

As auxiliaries to tapping and pressure, the only remedies to be recommended are iodine and diuretics. The former may be used both externally and internally. That the latter may be of some service, we have evidence in the fact occasionally observed, that the rapidity of the growth or refilling of an ovarian tumour keeps pace with the diminution of the urinary secretion; and that the remarkable increase of this secretion, often observed for some days after tapping, is sometimes accompanied by progressive diminution of the tumour, which recommences to fill only when the urine again diminishes.* In general, after tapping, the cyst speedily re-enlarges, and the operation has to be repeated as before; the cyst usually filling more rapidly after every such repetition. The second tapping may not be required till after several months; but subsequently the interval may diminish to a few weeks. This process generally exhausts the patient after some years; or an intercurrent inflammatory attack in the cyst, or in the peritoneum, may prove speedily fatal. Sometimes, however, patients survive to have the tapping very often repeated; and almost incredible quantities of fluid have thus been drawn off from the same woman.† In cases where the cyst refills rapidly after tapping, and where it is apparently monolocular, and has no solid mass in connection with it, injection of a strong solution of iodine, as in hydrocele, has been successfully practised. In employing this plan of treatment, the sac should be emptied as completely as possible; and for this purpose the flexible canula, or a gum-elastic catheter passed through and accurately fitting the canula of the ordinary

* Many authors of note entirely discredit the efficacy of all internal remedies. Burns says they have an equal effect "over the configuration of the patient's nose." Hamilton, on the contrary, as is well known, used the solution of muriate of lime internally as a discutient, and placed great confidence in it.

† Dr. Mead's patient, whose endurance is celebrated in the following epitaph, has now unfortunately been frequently surpassed.

" Here lies Dame Mary Page,
Relict of Sir Gregory Page, Bart.,
Who departed this life March 21st, 1728,
In the 56th year of her age.

In 67 months she was tapped 66 times,
Had taken away 240 gallons of water,
Without ever repining at her case,
Or even fearing the operation.

Dr. Martin of Norwich tapped a patient 80 different times, and drew off 6832 pints of fluid.

ascites-trocar, should be employed, a strong aqueous solution of iodine being introduced through this in a quantity proportioned to the size of the sac—from two to six ounces usually sufficing. When so large a quantity is required, if the tincture were used, the rapid absorption of the spirit would produce intoxication; even with the aqueous solution, symptoms of rapidly-induced iodism frequently ensue, and may for a time create anxiety unless the cause is understood. In those cases where this plan by injection has apparently failed, the disappointment has probably been due not to the same sac refilling, but to a smaller cyst developing itself and occupying the site of the former one.

These tumours may be dealt with summarily by extirpation. The operation is in some cases very simple. The patient having been suitably arranged and placed under the influence of chloroform, a wound is made through the parietes of such an extent as may be necessary—first for exploration, and then for removal of the mass. There is no good reason for incising the whole abdomen in all cases, from the ensiform cartilage to the symphysis pubis. The external incision should be proportioned to the bulk of the tumour.

The dissection is to be conducted carefully till the tumour is brought into view; attention being directed to arrest as far as possible all bleeding from the wound before opening the peritoneal sac. The tumour having been fairly exposed, its state as to adhesions and its pedicle, is now to be examined; and, if deemed advisable, the operation is continued. Unless the adhesions are very strong and extensive, they should form no insuperable obstacle. In fact, where the adhesions are merely superficial, and the intestines and tumour are not pressed together into an inextricably confused mass, the prognosis is by many at the present day considered more favourable than in a simple non-adherent tumour. The mass is next to be turned out of the abdominal cavity; and to effect this through the small opening, the larger cysts should be successively punctured by the trocar with the caoutchouc tube attached, so as to remove the fluid without disturbing the patient or allowing any of it to flow into the peritoneal cavity. As the tumour is drawn out of the opening, any attachments which exist are broken down by means of the finger-nails, or by the use of a director, or by the blunt points of a pair of probe-pointed scissors. When the pedicle is at length exposed, it should be included in the grasp of the clamp, and then divided. If bleeding ensue from vessels of any size in the parietes, or in the mesentery when detached from the surface of the tumour, these must be tied either with fine wire or with linen thread. If the bleeding consist of copious general oozing which compression with a sponge does not serve to check, a strong solution of matico, or even the tincture, may be applied to the surface. The raw surface and the surrounding viscera are sponged clean, and the wound closed. If unfortunately the bowels cannot be kept within the abdomen during the operation, means must be taken to maintain in them their natural heat till they are replaced; they may be immersed in water at blood heat, or wrapped in fine flannel moistened with tepid water. The pedicle, compressed by the clamp, is brought out at the lowest part of the incision; last of all, the wound is united by the interrupted wire suture, in such a manner as to expose as little as possible of its surface

to the bowels beneath ; and this is effected by passing the needle close to the peritoneal surface of the wound. The dressing of the pedicle and wound should consist of lint, soaked in oil, and covered with a large pad of cotton wadding, supported by a firmly-pinned binder. The clamp may be left on till it spontaneously drops off ; but it is better to remove it at the end of the third day, two or three long needles having been employed to transfix the pedicle and the cutaneous tissues on either side, so as to prevent its slipping back within the cavity of the abdomen. Should symptoms of peritonitis set in, the best application consists of a large warm linseed-meal poultice, renewed from time to time ; and when distension of the abdomen from fluid occurs, the lower part of the wound should be carefully opened to afford it an escape. Sometimes a limited abscess forms in the pelvis, and points towards the vagina, where it should be opened.

In conducting the first step of the operation, the plan proposed by Dr. Frederick Bird, to avoid mischances, may be resorted to—namely, to make at first only a small wound into the peritoneum, and to explore the tumour with the finger and probe ; so ascertaining, to some extent at least, the feasibility of completing the operation before the patient is compromised by further proceedings. Great hostility to all such operations is still declared by a large body of the profession. There are many cases, however, which may certainly render a duly-conducted attempt quite warrantable ; when the tumour is non-malignant, single, movable, and connected with a narrow pedicle ; when the patient is apparently free from other disease ; when the effects of this tumour are such as to threaten death by exhaustion at no distant period, unless relief be obtained ; when the ordinary palliative treatment, after due persistence, has failed to give relief ; and when the patient, having been made fully aware of the risk, is resolved and wishful to undergo the radical cure. Modern experience has certainly demonstrated, that moderately free incision of the abdomen, with exposure and manipulation of the peritoneum, is a less hazardous procedure than was generally supposed. But there are extreme dangers necessarily attendant upon this operation—from its site and its nature—from the danger of the clamp slipping, or the wound in the parietes partially opening, in consequence of distension of the bowels or of efforts in coughing—and from the risk of strangulation of a portion of bowel, either in the wound or by the contraction of bands of lymph. And, besides, the following unavoidable difficulties at present stand in the way of a general recommendation of the procedure ; namely, the confessed difficulty of diagnosis—as to the existence of extensive adhesions, as to the presence of malignant disease in the tumour or in the pedicle, and as to the large size and shortness of the pedicle rendering the use of the clamp almost impossible.

Sometimes cure is attempted by a minor proceeding ; making an opening in the abdominal parietes, only a few inches in length ; puncturing the larger cysts, and drawing out the tumour as the contents escape ; and then cutting off the attachment, after the application of the clamp. Such an operation, however, has not been found more successful than the more direct and open one ; and certainly it is not more easy

of performance. The danger of some fluid from the cyst escaping, and finding its way into the peritoneal cavity, and the impossibility of cleaning out the wound with the necessary care, are obvious objections to this mode of treatment.

The statistics of ovarian operation give a mortality of about one death in every three cases, though some speak of a fatal result as occurring only in the proportion of one in seven. Its dangers, then, are very considerable. On the other hand, hopes of relief from ordinary treatment of the tumour cannot be sanguine. Most patients are carried off by the disease in less than four years. Very few have the good fortune to be cured, and only a small number live beyond the four years. But it will always be a difficult and anxious matter for the surgeon to propose that a woman suffering, it may be, very little from this disease, should subject herself to the risk of almost immediate death, in order to obtain the chance of getting rid of that which might possibly permit several years of comfortable existence. The question of the performance of this operation, therefore, should not be decided so much upon general grounds, or on the statements of other operators, as by a careful consideration of all the circumstances in each particular case—favouring or forbidding its employment. The results as given by statistics are certainly not to be taken into account, as they seem to consist of the most heterogeneous materials ; containing, for example, cases where small non-adherent cysts in young girls have been satisfactorily removed—cases where the bowels and the tumour were so inextricably incorporated, that large masses of the tumour had to be left behind—cases where the removal was practised carefully and skilfully—and cases where the iliac veins were torn, the bowel divided, and towels, placed in the cavity to check the bleeding, were left there, and the wound stitched up.

Fibrous Tumours of the Uterus

May be found in any part of the organ. They may be single, but more frequently there are several present together. They may vary in size, from a pea to a man's head. They rarely occur before the age of twenty, and are most frequently observed about the age of forty.* They do not prevent conception, but cause great risk of abortion during pregnancy, and in delivery may obstruct the advance of the child, also favouring hemorrhage and subsequent inflammatory accession. The tumours themselves are liable to congestion, the inflammatory process, and suppuration ; and in course of time, they may become calcified in whole or in part, forming the uterine calculi of old authors. They may be developed in any part of the uterine wall ; the nearer to the mucous membrane, the greater is the hypertrophy of the uterine tissue. When the tumour is situated near to the peritoneal or to the mucous surface of the uterus, it may be protruded from the wall of the organ in a polypoid form ; and, the pedicle gradually diminishing in size, the tumour may drop off into the peritoneal cavity in the one case, and in the other may be expelled per vaginam. When the tumour is

* BAYLE states that in women above thirty-five years of age, fibrous tumours are found in one out of every five.

near to the mucous surface it is sometimes spontaneously discharged in another way, as has been observed to occur even in the case of large swellings; and not unfrequently this result has followed the irritation and pressure caused by the efforts of delivery, on the tissues interposed between the cavity of the uterus and the tumour. By ulceration or sloughing an opening is formed in these textures, and the substance of the tumour is exposed; disorganization ensues in the loose areolar tissue connecting the tumour to the uterus; contractions of the hypertrophied uterine tissue supervene; and expulsion of the tumour, in mass, or more gradually in parts, is the fortunate result. This may be called spontaneous enucleation; a process which has been imitated by art in some cases. If the tumour becomes polypoid, dilating the cervix or lying in the vagina, it may be treated as an ordinary uterine polypus. But it is to be remarked that more danger of uterine phlebitis attends the removal of this form of tumour, than of the ordinary uterine growth.

The symptoms attending the presence of these tumours are neither constant nor diagnostic. Physical examination alone can detect their presence and decide upon their nature. They are generally accompanied by feelings of weight, pain, or uneasiness in the hypogastrium—pain in the back, in the side, or in the thighs—disorders of the functions of urination and defæcation, etc.; but sometimes no symptoms at all exist. Often there is an increased amount of vaginal secretion and discharge, which may be checked by a mild astringent injection. Menorrhagia not unfrequently occurs, and may require the ordinary treatment, if severe; it is generally a sign of proximity of the tumour to the mucous membrane. Occasionally, but rarely, there is amenorrhœa. When these tumours have attained to even a very moderate development, the use of the uterine sound will usually shew a proportionate elongation of the long axis of the cavity; and in a still earlier stage, by dilating the cervix uteri by means of a sponge-tent, the presence of the fibrous tumour may be recognised in the thickness of the uterine wall. If the tumours become congested and inflamed, ordinary antiphlogistic treatment is necessary—especial attention being paid to maintenance of the recumbent position. If the tumours are large, prominent, heavy, or movable, an abdominal bandage or binder may be useful to support and fix them, and to afford the patient a feeling of security.

Nothing can be done in the way of discussing these growths; although discutient remedies, as iodine used externally and internally, counter-irritants, rest, the occasional local abstraction of small quantities of blood by leeching or cupping, have often a beneficial effect in removing disagreeable symptoms, and sometimes seem to arrest growth, or even to cause a diminution in size—probably by removing the surrounding swelling and engorgement. In some cases these tumours have been removed along with the uterus and ovaries, by an operation similar to that for the removal of the ovarian cystic tumour, and with such a fair measure of success as to justify a similar proceeding. When the tumour protrudes towards the uterine cavity, and dilatation of the cervix occurs, with pains resembling labour, spontaneous enucleation has sometimes been induced by the administration of the ergot of rye, assisted in some cases by the finger of the surgeon. Sometimes incision of the texture of the

uterus overlying the surface of the tumour towards the mucous surface, has been practised with the result of obtaining uterine contraction, and evolution of the growth through the vagina—assisted, it may be, by powerful evulsion on the part of the surgeon.

*Gastrostomy.**

In the case of insuperable obstruction of the pharynx, oesophagus, or cardia, it has been proposed to open the stomach by direct incision; attaching the edges of the opening in the stomach to the integumental wound; and thus constituting a permanent aperture, for the introduction of food, similar to what occurred accidentally in Alexis St. Martin. The operation is feasible in theory, and simple in performance. But its extension to cases of hopeless malignant disease seems scarcely expedient.†

Gastrotomy.

When the bowels are obstructed from an internal cause, beyond reach from the outlet, a question arises as to the expediency of performing gastrotomy, with a hope of relieving the obstruction. If that depend on fibrinous bands, or on intussusception, a simple manipulation might suffice to liberate the affected part. But the difficulty of diagnosis, and chance of failure, besides the danger of the operation, conspire to enforce great caution in resolving on such serious procedure. At the same time, when all ordinary means have failed, when several days have elapsed, and when the case is otherwise certainly hopeless, the doubtful chance of the operation may be afforded; more especially when pain, and other symptoms, point somewhat plainly to some part of the abdomen as the probable site of obstruction. At that part the incisions are made; with the precautions already spoken of. It may be happily in our power simply to disentangle and relieve; or, at the worst, the distended bowel may be evacuated by puncture, and an attempt made at establishing the condition of artificial anus. Of twenty-seven patients operated on, Mr. Phillips mentions thirteen, whose lives have been thus preserved.‡

Affections of the Diaphragm.

Surgically, the diaphragm may be affected by *penetrating wound*. This may prove formidable by hemorrhage, or by inflammatory accession, and has to be treated accordingly; or, these dangers avoided, a permanent aperture, an imperfect closure, or a weak cicatrix, may admit of protrusion of the abdominal contents at the injured point. Mr. Guthrie, in fact, regards this as an almost inevitable consequence; believing that cicatrization of a penetrating wound of the diaphragm never occurs. It may be so in large wounds, except, indeed, when adhesions form be-

* From γαστήρ, stomach; and στόμα, mouth.

† SEDILOT, Gazette Medicale de Paris, Jan. 1847; and Monthly Journal, April 1848, Retrospect, p. 68.

‡ PHILLIPS, Med. Chir. Transact. vol. xxxi. Lond. 1848; also Brit. and For. Rev., April 1849, p. 433.

tween the base of the lung and the margins of the aperture ; but when the wound is small, and the patient is kept quiet, there seems no good reason to suppose that the lesion will not heal ; the only ground for such suspicion being the fact, that a few cases have occurred where, after many years—in one example after nearly twenty-two—a fatal result ensued in consequence of the patency of the aperture. The risk of protrusion is especially great when the wound happens to be on the left side. The great danger, however, is not so much in the protrusion—which may exist for years, and form extensive adhesions within the pleural cavity—but by the occurrence of strangulation in the diaphragmatic hernia. In some cases, from simple displacement, the thoracic organs may suffer chronic disorder, not without a risk of ultimate asphyxia.

Rupture of the diaphragm may be produced by external injury or violent muscular effort. The risks by consequent misplacement of the abdominal organs are as in the former case. Such malposition is usually indicated by an anxious expression of countenance, a sunk empty state of the abdomen, corresponding fulness of the chest, thoracic percussion unusually clear or unusually dull, auscultation affording borborygmi rather than respiratory murmur, with obscuration of the sounds of the heart. In treatment but little is in our power.

Should *paralysis* of the diaphragm co-exist with ascites, obviously great care is specially necessary in withdrawing the fluid by paracentesis, lest dangerous collapse occur.*

* Von. C. W. MEHLISS, die Krankheiten der Zwerchfells des Menschen, Eisleben, 1845 ; also British and Foreign Med. Rev., July 1847, p. 166.

CHAPTER LV.

HERNIA.

By Hernia is understood a protrusion from within an internal cavity, of part of the contents of that cavity. But the term is usually limited to the most frequent form of such protrusion—namely, that from the cavity of the abdomen. And of this Hernia there are varieties, according to the site of the protrusion ; Inguinal and Ventro-inguinale, Femoral, Umbilical, Ventral, Phrenic, Perineal, Vaginal, Labial, Obturatorial, Ischiatic, Diaphragmatic. These, again, may vary according to the anatomical relation of their parts—Congenital, Infantile ; and according to the parts protruded—Enterocoele, Epiplocele, Entero-epiplocele, Hernia Litrica. And, further, other varieties depend on the pathological condition of parts—Reducible, Irreducible, Incarcerated, Strangulated.

The *Causes* of Hernia are predisposing and exciting. Whatever weakens the abdominal parietes at any point, predisposes to protrusion at that point ;—natural want of closeness of development, as at the groin and navel ; rupture of muscle and fascia, at any part, as in parturition ; atrophy of muscle, following bruise ; penetrating wound. Again, whatever tends to propel the abdominal contents with unusual force against such weakened or predisposed parts, directly excites or causes the protrusion ; as violent coughing, straining at stool, leaping, riding, or severe muscular exertion of any kind, especially such as produces powerful contraction of the diaphragm. And, further, the predisposing and exciting cause may be the same. Cough, straining, or habitual exertion of the abdominal muscles in any way, when long continued, tend to weaken and enlarge the natural outlets of the cavity, by constantly propelling the abdominal contents against the parietes—and thus prove predisposing. And then some sudden cough or strain effects protrusion, and proves the exciting cause. Hence it is, that sailors, gymnasts, and old men with coughs and urinary complaints, are especially subject to the ordinary forms of this disease.

The *component parts* of the tumour vary according to the nature of the protrusion. But, generally, they may be stated to consist of Coverings, Sac, and Contents.

The *Coverings* are far from uniform ; differing in the varieties of Hernia, and being seldom exactly the same in any two cases. In inguinal and femoral hernia, for example, the coverings differ widely ; and in each of these affections, the density, thickness, and even number of the investing layers, depend very much on accidental circumstances. In operating, it is vain to look for an unvarying sameness in this part of the tumour. In all cases of ordinary hernia, however, there is first the

usual integument, and then one or more layers of fasciæ. These will be enumerated, in the separate consideration of the varieties of hernia.

The *Sac* is the portion of parietal peritoneum which is pushed before the protruding viscus, and which forms its immediate envelope. Sometimes it is wanting; as in hernia following directly upon wound, and in protrusions which consist of the caput cœcum coli, or bladder. In the great majority of cases, we are to count upon its presence—adherent or not to the extra-abdominal parts with which it is in abnormal contact, according to the duration of its presence there, and the occurrence or not of adhesion between the surrounding parts and its exterior. We ordinarily speak of the *neck* and *body* of the sac, as we do of the neck and body of the general tumour; the neck being that portion, of smaller calibre, which is at and near the aperture of protrusion, and the body being understood to be the more globular swelling beyond. If the tumour have been long protruded, without reduction, and otherwise but little altered in its circumstances, the neck of the sac is apt to become dense and unyielding in structure, and the calibre in consequence is at that part of a fixed nature. When, under the application of a fresh exciting cause, a new protrusion takes place, there is an extension in the sac, corresponding to the increased bulk of its contents; but, not improbably, the propelled original neck of the sac does not change, except in its position only; and, remaining of its contracted dimensions, it may become the seat of stricture in the case of strangulation—the new neck proving comparatively free and accommodating. This circumstance has obviously an important bearing on the operation for relief of strangulation.

The *Hernial Contents* are various, inasmuch as every abdominal viscus is liable to protrusion; but the most frequently affected, by far, are the intestines and omentum; one or other, or both. If intestine alone is protruded, the tumour is said to be an *Enterocœle*; *Epiplocele* implying descent of omentum; and *Entero-epiplocele*, descent of both. Sometimes only a redundant portion of bowel escapes, in the form of a diverticulum; and this is termed a *Hernia Litrica*.

The *Diagnosis* of hernia is a practical subject obviously of the highest importance. A hernia in its ordinary or reducible condition, is a colourless, elastic, compressible swelling, at the site of an abdominal aperture; protruding when the patient assumes the erect position, and receding when he lies down; receiving an impulse on coughing, and tending to enlargement under any exertion of the abdominal muscles; gurgling under pressure if containing bowel; capable of being replaced, by very moderate pressure, within the abdominal cavity; and easily retained by very gentle support, if accurately made upon the aperture by which it escapes. In the early stage of its development, when as yet there is only a tendency to its formation, a hernial protrusion is indicated to be in progress by the uneasy sensations complained of at a site where such protrusions are common, and by the existence of a sense of distensile bulging communicated to the finger, or even apparent to the eye, when the patient coughs, sneezes, or otherwise exerts his respiratory muscles to sudden consentaneous contraction. The tumour, as it progresses, comes from within outwards, causing more and more protrusion, and assuming more of an oval, rounded, or pyriform shape. There are certain affec-

tions for which such tumours are especially liable to be mistaken ; but a consideration of these had better be reserved till the different forms of hernia, and affections with which they may be compounded, come under consideration.

Reducible Hernia.—At some part of the abdominal parietes, usually after some unwonted exertion, a tumour such as we have described occurs. An enterocele is smooth, elastic, and more or less globular in form ; gurgling on pressure, and, when manipulated with the object of effecting its return, often abruptly receding—the reduction taking place *per saltum*. An epiplocele, on the contrary, is doughy and more irregular in form ; it emits no noise ; and reduction is slow and gradual.

The treatment of reducible hernia consists of *prevention, reduction,* and *retention*. Not unfrequently there are premonitory symptoms of protrusion, and it is then that *Prevention* is in our power. Pain, slight fulness, and distensile impulse on coughing, appear at an abdominal outlet, after unusual exertion ; and uneasy sensations are experienced when the patient stands long, has to exert his arms in any way, or speaks with a loud voice, or with a sustained effort. Hernia is about to form. In order to avert it, the exciting cause is removed, by discontinuing all undue abdominal exertion, as much as possible ; unloading the bowels by the use of gentle laxatives ; and by careful regulation of the diet avoiding fæculent accumulation or flatulent distension. And the predisposing cause is met, by a well-fitting elastic truss being worn on the part, so as to strengthen what is weak in the parietes, while at the same time a mechanical obstacle is directly opposed to protrusion.

Should hernia actually form, replacement, or *Reduction*, cannot be too soon effected ; inasmuch as the parts when protruded are ever liable, from apparently but slight causes, to the supervention of strangulation—a state fraught with the utmost danger to life.

Reduction is effected by placing the patient recumbent, slightly elevating the trunk, loosening the dress so as to remove all outward pressure from the abdomen, and in short taking every means to relax the abdominal parietes ; then gentle, steady, and equable pressure is made with one hand, upon the fundus and body of the sac, urging back the protrusion in the direction whence it has come, while with the other the contents are diminished in calibre as they approach the neck of the sac. Such manipulation is termed the *Taxis*.

Retention is effected by continued and suitable pressure at the site of protrusion ; and this pressure is best made by means of a truss ; consisting especially of a steel spring, with a compressing pad and counterpad at the extremities. Of these instruments many varieties have been constructed ; but, of late, opinion seems to have inclined, very justly, towards a decided preference for the simple spring with its ordinary cork pad ; provided that the instrument is accurately adapted to each individual case ; the pad fitting nicely to the abdominal outlet—not too conical lest permanency of dilatation should be so maintained, and yet not so flat as unnecessarily to diffuse the pressure ; the spring, in the case of the inguinal and femoral forms of rupture, passing about two inches beneath the crest of the ilium, grasping there firmly, and terminating in the counterpad, a little way beyond the spinous processes of the lumbar

vertebræ ; and this spring not so strong as to gall the parts by inordinate pressure, yet strong enough to shut up the opening effectually. A thigh strap passing from the back part of the spring to the pad, so as to prevent that from being displaced upwards, will also be found in many cases essential ; and, to avoid chafing, a piece of folded lint or linen may be interposed beneath the instrument, at the sites of pressure. At night, the truss may be removed, on the patient lying down in bed, unless he is suffering from cough. In the morning it should be the first article of dress to be adjusted ; great care being always taken that the pad fits accurately, does not tend to become displaced and permit protrusion during exertion, and that it exerts the required degree of restraining pressure. Should at any time reprotrusion occur, the instrument must be instantly removed, and means as instantly taken for replacement and accurate readjustment.

By careful and constant use of the truss, a radical cure is expected in the child.

As, in the adult, the truss, however carefully and patiently worn, generally proves but a palliative, *Radical Cures* have naturally been eagerly sought for. Of these, several have been applied more particularly to the inguinal hernia. In recent times those methods which consist in (a) the invagination of a cutaneous or subcutaneous plug, to occupy the gap through which the protrusion has occurred—or (b) by which the parietes of the aperture are approximated by means of wire sutures or pins—have secured a greater amount of success than any of the older, clumsier, and less accurate procedures. As, however, the method of applying these principles of treatment requires special adaptation to each form of hernia, we shall delay any further consideration of them until we have described the sites at which hernial protrusion usually occurs.

Irreducible Hernia.—A hernia is said to be irreducible, when it cannot be reduced, and is permanently fixed in its extra-abdominal position. This state may be caused—1. By adhesion of the sac, on its external aspect, to the parts into which it has been protruded ; and by adhesion of its internal surface to the hernial contents. In a neglected hernia of any considerable duration, the former event seldom fails to take place ; and to constitute the second, plastic change has only to form on the opposed surfaces. 2. By the nature of the protrusion. The caput cœcum coli is uncovered by peritoneum posteriorly. It may slide down through the parietes ; and, presenting at the groin, it may constitute an irreducible tumour—as well as a hernia without a sac. In such circumstances, the areolar adhesions of the displaced cœcum may have been extended and shifted but not broken ; and they may present an insuperable obstacle to replacement. But this is not always the case ; the bowel may have a more extensive peritoneal investment than usual ; and, instead of merely descending with its areolar connections, may acquire a complete mesentery—so becoming easily reducible.* 3. By contraction of the abdominal cavity. When a large hernia has been long unreduced, it may, to a very great extent, become permanently irreducible, although no adhesion form between the contents and the sac. The abdominal cavity, having parted with the greater proportion of its more movable

* *Lancet*, No. 1235, p. 462.

contents, contracts upon the remainder ; and then there is found to be no room for replacement of the extruded parts, even were circumstances quite favourable for such reduction.

Irreducible herniæ are predisposed to evil. The patient usually suffers from flatulence, indigestion, and constipation. The peristaltic movement of the protruded bowels is imperfect, while the part is constantly exposed to causes of incarceration and strangulation. Such cases, therefore, require to be watched with unusual care. The bowels are to be carefully regulated ; all excitants of intestinal disorder are to be avoided, as well as unnecessary abdominal exertion ; and, according to the size of the protruded contents of the sac, a hollow pad, or bag truss must be constantly worn, so as both to support the protruded parts, and prevent the occurrence of further protrusion. No direct interference is warrantable, with a view to remove the obstacles to reduction. But, should strangulation occur, the ordinary operation is to be performed, for relief of the constriction.

Incarcerated Hernia.—This term denotes a temporary retention of the parts, previously reducible, in their abnormal position, without obstruction to the faecal flow, and without the occurrence of inflammatory disease. No urgent symptoms call for reduction ; but when this is attempted, it is found to be impracticable under existing circumstances. There may be—1. An enlargement of the hernial contents. The gaseous matter may have become expanded ; the fluid and solid contents may have accumulated in unusual quantity ; or a portion of extruded omentum may have slowly expanded by serous or plastic accumulation within its areolar tissue, or by a more gradual change due to increased growth of adipose tissue ; and the tumour—thus enlarged—becomes too bulky to repass the outlet. Or, 2. While possibly the tumour may be but little changed, the aperture through which it came may be temporarily contracted—preventing replacement, yet not causing constriction and strangulation ; and this state may be due to muscular spasm, or to swelling of the fibrous textures dependent on an advancing inflammatory process.

Treatment is regulated by the cause. Gaseous contents may be diminished by the continued application of cold ; solid and fluid, as well as gaseous contents, may be favourably acted on by purgatives and enemata ; a fatty omentum may be diminished by rest in the recumbent posture, with starvation and depletion, and the use of cathartics ; and, then, the reduced tumour may be pushed back within the abdomen. Spasm, should it exist, is overcome by the warm bath, opium, chloroform, or other antispasmodics ; inflammatory change will subside under antiphlogistics, followed by discutients ; and through the cleared outlet a comparatively unchanged protrusion may again be returned. Until this desirable event can be achieved, the part ought to be supported by a bag truss or otherwise ; and every precaution should be taken to avert the occurrence of strangulation—to which such tumours are especially liable.

Strangulated Hernia.—Strangulation is said to have taken place, when faecal flow is mechanically arrested in the hernial tumour by tightness of constriction at the neck ; and when, usually from the same cause, circulation has been disturbed in the protruded parts, and the inflamma-

tory process is begun ; also when incarceration exists, with interruption to the vascular flow, with an inflammatory process in the protruded parts certainly following, sometimes, however, preceding constriction. This distinction must be made ; because we may have all the symptoms of strangulation present, constipation among the rest, while the protrusion consists of omentum alone ; as also when the bowel is implicated, with only a small portion of its circumference included in the protrusion. The symptoms of strangulation, in the protruded viscera, may either occur immediately after their escape, or be developed, either acutely or gradually, at a more or less distant date. The constriction may sometimes depend on spasm, or on some structural alteration in the abdominal outlet ; but is usually due to change in the hernial contents caused by sudden, or at least rapid and unusual, enlargement of the protruded parts—in consequence of which, the neck of the tumour becomes diminished in proportion to the bulk of contained viscera. This increase in the size of the protruded parts may be caused by the occurrence of a fresh protrusion ; or by the accumulation of fæculent or gaseous contents within the bowel ; or may be due to the inflammatory process set up in the protruded parts, causing both vascular engorgement and serous accumulation. The inflammatory accession is much more frequently, however, in a strangulated hernia, consequent upon constriction, and caused by it.

The symptoms of strangulation are very marked. The patient is annoyed by flatulence, general uneasiness, and restlessness. The bowels are obstinately constipated ; complaint is made of a twisting burning pain referred to the umbilical region ; sickness and retching occur, with upward evacuation of the contents of the stomach, mixed with bile ; then the contents of the small intestines are ejected ; and latterly, both in appearance and smell, the vomited matter becomes fæculent, or *stercoraceous*. The tumour, although resisting efforts at reduction, is not necessarily at first either tense or tender, but soon becomes so ; and the pain, which increases rapidly, usually extends to the neighbouring parts of the abdomen. The contents of the sac are in fact becoming implicated in the inflammatory process, which may either affect them alone, or extend to the peritoneum and contents of the abdominal cavity. At first the pulse may be hard and increased in rapidity ; more commonly, however, from the very commencement it is small and feeble, while the face is pale, the expression sunk and anxious, and the features shrunk. The tumour now becomes more and more tense and painful—perhaps intolerant of even the gentlest pressure. Great pain affects the whole abdomen, with aggravation and twisting at the umbilicus. Nausea and vomiting continue ; the countenance is bedewed with clammy perspiration ; there is great restlessness, and distress is constant ; the pulse grows more rapid and indistinct ; hiccough sets in ; the tumour becomes less intolerant of manipulation, less tense and painful, and feels doughy and crepitant on being handled. These latter symptoms denote that gangrene has taken place. Then vomiting may cease, and sudden cessation of pain and discomfort may be experienced ; perhaps the bowels act imperfectly ; and the patient may express himself not only relieved but confident of recovery. Sinking, however, continues ; and the fatal issue is not long deferred.

Such is the ordinary course of a strangulated hernia, unrelieved. But there may be another and less formidable termination. In the progress of the case, the integument and other envelopes of the tumour become involved in the inflammatory process; at first they are bright red, tense, and very painful; afterwards darker in hue; less painful and tense, cold, phlyctenulous—in fact gangrened. The contents are in a similar condition. All slough. And, on separation of the mortified parts, copious *fæculent* discharge takes place; relief follows immediately; the urgency of the symptoms is over; and gradual recovery may ensue, with the establishment of artificial anus.

In the preceding enumeration of symptoms, we have first the signs of obstruction, and then those of inflammatory accession, in the protruded parts. The obstruction may, however, be to all appearance absent. Constipation, as we have seen, is not altogether due to mechanical obstruction, and may therefore in an omental hernia be less decided. In such cases, or sometimes even when mechanical obstruction to *fæculent* flow is complete, the evacuation of the contents of the colon, or even in part of the small intestine when the interruption is situated high, may be mistaken for a satisfactory movement. In other cases, the troublesome and urgent desire to go to stool which the patient experiences may, for a time, deceive himself, his friends, and even the practitioner, into the belief that the disease is simply diarrhoea or dysentery. In other cases again, especially in large irreducible herniæ, the inflammatory process, instead of resulting from the constriction, may be the original affection; caused, perhaps, by a blow—though a less direct and palpable exciting cause may suffice. The tumour is painful, and red, and swollen, even for some time, while as yet the abdomen is free from ailment, and the bowels are working naturally. Then the pain and tension are chiefly at the body of the tumour, in the first instance, instead of at the neck as in primary constriction. But, the inflammatory process continuing, engorgement with serous accumulation takes place, the bulk of the whole tumour is increased, in consequence constriction occurs—and then follow obstruction of the bowels, affection of the abdomen, and aggravation of the local disorder.

The rate of progress varies according to circumstances. When the tumour is small and recent, constriction is usually tight; and especially in the young and vigorous, death of the parts, at least if unrelieved, is certain in a few hours. Whereas, if the hernia be of some size and long standing, and if obstruction precede the inflammatory process, and neither prove urgent, days may elapse ere much local mischief is done, or the system becomes involved. On the average, however, it is not by days but by hours that the registration of time is made in cases of strangulated hernia. And, by the practical man, time should invariably be regarded as of vital importance.

Many, if not all, of these symptoms may exist, independently of either hernia or strangulation. Whenever they do occur, however, hernia is invariably to be suspected, and the necessary inquiry and examination should be made under all circumstances. There may be no tumour found at the ordinary sites of protrusion, or at any other accessible part of the abdominal parietes; then it is probable that the symptoms are

independent of hernia—purely abdominal. If a hernia is discovered, of old standing and considerable size, not very tense or painful ; if the pain is not greater in the tumour than elsewhere—perhaps not so great ; if the bowels are acting, though perhaps imperfectly ; if, on inquiry, it is ascertained that the abdominal and general symptoms plainly, and by some considerable time, preceded change in the tumour ;—then the probability is, that the affection is enteritic or peritonitic, originating in the general abdomen, affecting the tumour secondarily, and perhaps even in a minor degree. When, however, the signs of strangulation are found marked and acute, and the history plainly indicates precedence of the local and extra-abdominal signs of disorder, there need be no doubt that the case is of the ordinary kind—the urgency essentially dependent on strangulation of the hernia. In such circumstances, the presence of any suspicious swelling or fulness, which may possibly be due to the presence of a hernia, should, with the persistence of the symptoms, fully justify an exploratory operation to determine its true nature.

Treatment of strangulated hernia necessarily varies according to the nature of the case. In general, it may be said that our object is to effect reduction as speedily as possible ; saving structure, by favouring decline of the inflammatory process ; restoring the normal passage of the intestinal contents ; and arresting the disastrous progress of constitutional disturbance. But it is not always good practice to have recourse to the manipulations for reduction immediately ; and, in regard to this practical point, the cases may be divided into two great classes ; those which are preceded by inflammatory change in the hernia, and those in which this follows on constriction otherwise produced. The latter, doubtless, are the majority. In the former, it is the natural and proper course of procedure to remove the cause of constriction, if possible, in the first instance—provided the case is chronic enough to admit of this ; leeches are applied, and other suitable antiphlogistics enforced ; and when, by such means, the bulk of the tumour has diminished, and the parts have also acquired a better tolerance of manipulation, then reductive pressure may be employed—without risk of doing harm, and with a good prospect of proving successful. But, in the other class of cases—where the constriction has caused inflammatory accession—by the removal of the former alone can we expect to cope successfully with the latter, and save the life of the patient.

In employing leeches for the relief of hernia, it is well not to apply them to the tumour itself, but to its immediate vicinity ; otherwise, the slipperiness which is produced, by oozing of blood, may interfere seriously with the manipulations of the taxis.

In applying the taxis, the patient is placed recumbent, and with the limbs and trunk so arranged as to relax the abdominal parietes to the full ; it is well also to see that the bladder is empty, and that no bandage, belt, or other outward constriction is affecting the abdomen. The tumour is then grasped with the hands, firmly yet cautiously ; and while with one hand general pressure is made on the bulk and body of the tumour—forcing it in upon itself, as it were, and at the same time pushing it back in the direction whence it has been protruded—a kneading or pinching movement is made on the neck of the tumour by the fingers

of the other hand, so as to disentangle and free the part most compacted and compressed. And this is steadily persevered in, for some time, provided the patient do not complain greatly of aggravation of pain and general uneasiness. Our wish is to push the hernial contents back, not in mass, but in detail; those going first which were last protruded. The patient, if not chloroformed, is kept in conversation, to prevent him from straining his abdominal muscles in involuntary opposition to the operator. There is energy, yet no violence of force in the pressure; and it is patiently and steadily maintained, yet not continued too long—that is, not after reasonable hope of its success has passed, and when its maintenance must inevitably tend to serious aggravation of the crescent inflammatory process.* Sometimes it is not applicable at all; when, for example, the case is acute, and has made great progress ere assistance is called; when the parts are so obviously intolerant of pressure, as to convey to the practised hand and mind the apprehension of texture giving way by rupture under an attempted taxis; also, when we are satisfied that inflammatory change has already gone so far as to render loss of substance, either by ulceration or by sloughing, inevitable in the constricted parts.

Sometimes benefit accrues from an opposite direction of gentle force, previous to the reductive application of it; bringing down the jammed neck from the abdominal aperture, and so favouring clearance of the passage by an unravelling, as it were, of its contents; causing, in fact, a slight increase of the descent, before the whole is attempted to be replaced. A bluff forcing of the fundus of the tumour on its neck is especially to be avoided, when replacement is intended; for the effect of this, in the case of protruded bowel, is not only to jam the parts yet more, but actually to favour formidable accession to the tumour's bulk by traction from the aperture downwards.

By some it is thought that much may be done by position alone; flexing the thighs, rotating the limbs inward (for inguinal and femoral hernia—especially the latter), raising the nates till the whole weight rests on the shoulders, retaining this position for a time, then lowering and raising again, the hand of the surgeon meanwhile making gentle pressure on the tumour. It is thought that the posturing tends to pull the contents out of their sac.

Failing in the well-applied taxis, we naturally look for *Auxiliaries* to it; and we find a catalogue of these, analogous to the aids of reduction in dislocation. Some act on the contents of the tumour, tending to reduce bulk; others affect the abdominal outlet, tending to enlarge space by relaxing the abdominal parietes—making easy room, either way, for replacement of the dislocated parts. And here it may be stated, that though in many cases the abdominal outlet is in the first instance free from change, and constriction depends on alteration in the contents; yet, strangulation having occurred, the abdominal parietes at the site of the hernia become involved in perverted action, and sooner or later are irritated into spasm. And hence it is, that the most useful auxiliaries are such as tend to abdominal relaxation.

* For a sample of the injuries done by imprudent taxis, see Teale on Hernia, p. 96.

1. *Venesection* is now-a-days rarely advisable. Before the introduction of chloroform, it was applicable in the comparatively young and robust, of inflammatory tendency, tolerant of loss of blood ; with a tight strangulation yet recent, marked signs of advancing acute disease in the parts, and the constitutional symptoms still evincing a sthenic type. In such circumstances, the copious and rapid abstraction of blood from the arm was of use, by both combating the advancing inflammatory affection, and at the same time tending to cause complete prostration of the muscular system of the abdominal parietes. 2. The *warm-bath*, having similar tendencies, was more generally applicable, inducing temporary depression ; gaining the desired end, yet saving the system from actual loss. If there be time, this is still one of the best means of assisting the taxis. The patient is placed recumbent in the bath, with the abdominal parietes relaxed by posture ; and, when faintness is beginning to be complained of, the taxis is resolutely applied. It may fail ; but the opportunity by the bath is not yet over. Let the patient be replaced in bed ; in a few minutes he will be found deluged in perspiration, with a muscular system more prostrate than before ; and then the taxis is most likely to succeed. 3. *Fomentation* is inapplicable ; as, by rarefying the gaseous contents, and favouring fluid accumulation in the sac, it could only increase the bulk of the tumour ; while it is too feeble and limited in its relaxing effect, to act favourably on the abdomen. 4. *Antimony*, as a nauseant and prostrating agent, is very inferior to the bath ; adding greatly, and in a dangerous degree, to the irritability of the stomach, and to the downward tendency of the constitutional symptoms. It is inapplicable. 5. And, for a like reason, let *Tobacco* be used very warily, if at all. By other, less hazardous, and more manageable auxiliaries, our object may be as speedily obtained. 6. *Opium*, following blood-letting in cases of a marked inflammatory nature, or given singly in others, is productive of very satisfactory effects ; the dose, however, must be a full one—not less than two grains—for the adult. The beneficial effect is twofold. Constitutionally, the system is rendered more tolerant of the depressing effects of strangulation ; the remedy being in fact equally useful here as in the case of intense abdominal inflammatory disease unconnected with hernia. Locally, very great service is obtained by muscular prostration, so soon as the full narcotic effects of the drug have been established. This requires time, however ; and consequently opium, like the warm bath, is not applicable to all cases—at least as an auxiliary of the taxis ; for, in all, there is not time to await the operation of the remedy. 7. *Chloroform*, as has elsewhere been stated, is almost equally serviceable here as in dislocation ; producing thorough relaxation, not aggravating collapse, quickly passing off, and leaving no unpleasant trace behind. At the present day it is chiefly depended upon as an auxiliary ; in fact, in recent and acute cases, when the taxis has failed after having been given a fair trial, with the patient deeply under the influence of chloroform, it is rarely expedient to wait longer, or resort to the use of any other means before having recourse to operation. 8. *Glysters of acetate of lead*, each containing ten grains dissolved in about six ounces of water, have been employed with suc-

cess ; repeated, if necessary, every two hours ;* but in a case of acute strangulation such delay might prove very dangerous. 9. *Purgatives* are in all cases of strangulation most unwarrantable. The bowel is locked ; and the stimulus of purging, quite unable to undo the locking, acts but injuriously, in applying a stimulus which cannot be obeyed, and aggravating an already crescent inflammatory process. In the case of incarceration, the wary use of purgatives is often serviceable, in unloading the protruded bowel ; but in the tighter degree of constriction, causing strangulation, they are never to be thought of. 10. *Enemata*, however, have a different character. When simple and bland, however freely and largely administered, they have not the pernicious properties of purgatives—more especially of those which are drastic and given by the mouth. Besides, they are positively of use, by disburthening the lower bowels of their contents, both solid and gaseous ; and so making room within the abdominal cavity for reception of the extruded parts. Experiment would also lead us to suppose that they have a mechanical tendency to extricate, by exciting traction, from within, on the constricted and protruded bowel.† 11. The long elastic *Rectum-tube* is also both safe and useful, when passed high and cautiously, so as to reach the colon ; the object being to evacuate the gaseous contents of the lower bowels more thoroughly than enemata can do, and so to make room within the abdomen. But, obviously, such a proceeding is only applicable to those cases in which distension of the lower bowels exists. 12. Some auxiliaries affect the tumour mainly. Certain cases, we have already seen, render it necessary that local blood-letting should precede the taxis. Fomentation, as already stated, is worse than useless. But the *application of Cold* is sometimes of the greatest service. Applied indiscriminately, it will do harm ; but limit its use to those cases which are chronic in their progress, in which the signs of obstruction plainly precede those of inflammatory change, and in which the inflammatory process affecting the tumour is not only slight but scarcely begun—then the effect is often most favourable. The gaseous contents being condensed, bulk is diminished ; muscular energy is probably somewhat lowered, and space is gained ; and, perhaps by puckering the investments of the tumour, some little reductive pressure may be so exerted. Act as it may, there is no doubt that the local application of cold tends wonderfully to assist the taxis, in the class of cases just described. It may be applied by sprinkling the tumour and surrounding parts with æther, and keeping up a continuously rapid evaporation by directing a current of air upon the part. Should this fail, great care must be taken for some time not to apply heat suddenly, by fomentation or bath, or otherwise to cause rapid exaltation of temperature, for very obvious reasons. Ice and freezing mixtures are less suitable ; being apt, by doing too much, to act injuriously on the hernial contents. 13. *Acupuncture* has been proposed, when the constricted bowel is obviously distended by gaseous contents. But the use of cold is likely to obtain the same end, as effectually, and more safely. 14. *Posture* may be considered rather as a part of the taxis, than as auxiliary to it ; so invariably

* Brit. and For. Rev., Jan. 1849, p. 271.

† Lancet, No. 1035, p. 468.

is it to be attended to. It necessarily varies, in details, according to the site of the protrusion. Its main object is ever the same ; to relax the parts through which reduction has to be made. In hernia at the groin, as already stated, it has been thought that elevation of the pelvis, with a hanging position of the recumbent body, has been of use in exerting an extricating traction on the strictured parts.

The most available, and most generally used of these auxiliaries are : —blood-letting—local in all the inflammatory cases, and general in the few examples which admit of it ; the warm bath ; opium ; chloroform ; simple enemata, in large quantity ; perhaps the long tube ; in the chronic and uninflamed cases, always the local application of cold. If the taxis is to succeed, a yielding of the tumour is felt beneath the hands, the contents are plainly shifting ; then a gurgling noise is heard, denoting replacement of the gaseous contents—always a welcome sound ; and speedily thereafter the solid matters recede, sometimes very gradually, often as it were *per saltum*. A truss, or suitable compress and bandage, is instantly applied ; the patient is confined to bed, recumbent ; antiphlogistic regimen is strictly enforced ; after some hours, an enema may be given, if the bowels have not acted spontaneously ; but not till after many hours should even the simplest laxative be given by the mouth, it being well ascertained that the loop of bowel included in the stricture remains long in a paralytic state, and incapable of obeying the peristaltic stimulus. There is, in short, the same serious objection to purgatives immediately after reduction, as during the existence of strangulation. Should peritonitic or enteritic symptoms threaten, the usual antiphlogistic treatment must be had recourse to, both early and with energy. Not unfrequently, after tight constriction, discharge of blood takes place *per anum* ; this doubtless being furnished by the mucous coat of the lately strangled part, which always suffers sooner and more than the serous and muscular tunics of the intestine.

Large herniæ are more hopeful of reduction than the small ; the inguinal protrusions are more hopeful than the femoral ; the congenital hernial protrusion of children rarely resists well-conducted efforts at the taxis.

It may happen that under forcible application of the taxis, in a recent hernia, the tumour recedes suddenly, in mass or "*en bloque*" as it is called by French authors. This is not desirable. For, it is not improbable that the untoward symptoms may continue, quite unchanged ; the reason being, that as the sac and its contents have returned together, with their relations unaltered, the neck of the sac probably continues to constrict the omentum or bowel, as before. In such a case, treatment becomes embarrassed. But the safe proceeding most certainly is to expose the abdominal outlet by operation, in search of the yet strangulated bowel ; aiding that search by making the patient cough, or otherwise exert himself, so as to favour re-descent of the hernia. An operation under such circumstances is much more promising of success, than gastrotomy on account of an undefined internal obstruction. For in this case the cause of strangulation is plainly in the sac, and that is within reach at a fixed point, the parietal relations of the sac being certain to detain the reduced mass close to the

site of protrusion ; or should the hernial contents have returned in mass without carrying the sac along with them, they will certainly be found close to the neck of it. They will easily be recognised in most cases, forming a tense resisting swelling felt by the finger introduced through the abdominal opening into the cavity of the peritoneum, and can be brought down again into the sac by means of a pair of dressing forceps or a blunt hook.*

The operation for strangulated hernia is unhesitatingly to be had recourse to, so soon as the taxis, with such auxiliary means as seem advisable, has been fairly tried, without success. All experience proves that in regard to this operation error is more frequent on the side of delay than of precipitancy. Two circumstances demand its instant performance ; a conviction that by no other means, than by the edge of the knife directly applied, can the abdominal outlet be so enlarged as to relieve constriction and admit of replacement ; also, a conviction that already inflammatory disease has advanced so far, that either ulceration or sloughing is inevitable in the protruded parts. In the one case, we operate to relieve the stricture and effect replacement, hoping to arrest the inflammatory process ; in the other, we operate to relieve the stricture, and, leaving the hernia unreduced, prevent fatal extravasation of intestinal contents within the abdomen—hoping also to limit the inflammatory attack to the directly implicated parts. The danger of strangulation is twofold ; formidable disturbance of the system, and untoward inflammatory progress in the tumour. Both dangers advance, in most cases, with rapidity. And if we wish to meet them successfully, the measures of relief must be not only suitable but early ; in other words, time, all valuable, must not be wasted in ineffectual attempts at the taxis, when the case at all partakes of an acute character. When, also, the case is of the obscure nature already described—and it is difficult to say whether the hernia is to blame or not for occurrence and persistence of the untoward symptoms—let the operation for relief of stricture be performed. When the tumour itself is of an ambiguous character, when we are not certain whether it is a hernia or not, and yet the ordinary symptoms of strangulated hernia are present—again let the surgeon operate. It is well he should approach error on the safer side.

It has been proposed to relieve the stricture by means of subcutaneous section. But this proceeding is obviously so beset with danger and uncertainty as to be quite inapplicable.

The seat of stricture is exposed by careful and regular dissection ; the incisions necessarily varying in their plan, according to the kind of tumour. In small herniæ, they should correspond both to the fundus and the neck of the tumour ; in large protrusions, an incision over the neck is alone required. Having cautiously divided the integuments and different layers of fasciæ which constitute the envelopes of the hernia, the sac is exposed in recent cases, clear and glistening, resembling very much the peritoneal coat of the bowel ; so much so, in fact, that there may be some difficulty at first in feeling sure whether it is the sac or bowel. By pinching it up, so as to show bowel separate beneath ; or by observing serum, fat, or a portion of omentum between, we arrive at a sure diag-

* Monthly Journal, Retrospect, Feb. 1849, p. 35.

nosis. The sac having been exposed—or nearly so—are we to open it, examine the state of its contents, and divide the stricture from within? or are we to attempt division of this from without, leaving the peritoneum intact, and so escaping the danger of peritonitis? So long ago as 1720, Petit proposed this modification of the procedure—leaving the sac unopened; and the proposal met with a varied reception subsequently—inclining to distrust rather than otherwise. Lately, however, it has been revived under better auspices (Aston Key, Luke, Gay); and in suitable circumstances, it may be considered as the established and preferable practice. Were it applied indiscriminately, nothing could well be conceived more pernicious; bowel or omentum might be reduced when they ought not; or, one stricture having been relieved, another might be left—this second existing in the sac, perhaps below its proper neck, and continuing to embrace the hernial contents with fatal tightness after reduction. But, limited to those recent cases of strangulation in which we are certain that the hernial contents are sound and reducible, and in which we are also certain that the only stricture is that which we propose to divide—then, doubtless, the extra-peritoneal operation is by much to be preferred. It is also suitable in cases of irreducible hernia, which have become strangulated; and in which, from their large size, the exposure of peritoneum may reasonably be expected to prove especially hazardous.*

If the case appear favourable for extra-peritoneal division, the investing textures are carefully incised at the neck of the tumour, so as to admit the point of the finger, or at least the finger's nail, in contact with the tight orifice of the abdominal aperture; and then on the finger's point, so introduced, a probe-pointed bistoury is passed, and by it the necessary enlargement is effected. If the stricture be in the neck of the sac itself, even that may perhaps be relieved extra-peritoneally, by carefully scratching the outer surface by the point of the knife.† Then the taxis is applied; the parts are reduced—the contents going first, and gradually, otherwise stricture might remain after reduction; if the unopened sac be non-adherent, it is pushed back also; the wound is brought together; and, by suitable adaptation of compress and bandage, and avoidance of the ordinary exciting causes, reprotrusion is prevented. There is always the possibility of adherent and entangled bowel and omentum being reduced *en masse*, which may maintain the symptoms of strangulation. And, therefore, should these continue unrelieved, a second operation should be had recourse to, by opening the sac, as already mentioned, and feeling with the finger introduced into the abdominal cavity for the portion of bowel which had been reduced. This should be drawn down and examined, if it feel distended, tense, or

* Indiscriminate performance of the extra-peritoneal operation must often lead to serious and fatal error. Selection must always be carefully made. For objections to the operation, *vide* HANCOCK, Observations on the Operation for Strangulated Hernia, Lond. 1850.

† According to Mr. Luke, the site of stricture may be ascertained previously to operation, by making impulse on the fundus of the tumour with one hand, while the other is placed on the neck. Wherever impulse stops, there is the stricture.—Med. Chir. Trans. vol. xxxi.

matted together. Any constriction which exists may be divided, or the intestine and omentum unravelled or separated; and then, first the intestine, and afterwards the omentum, is to be returned within the abdominal cavity.

But if it be deemed expedient to open the sac, it should be pinched up by forceps; choosing a part where serum or fat interposes between it and the bowel—and that will generally be towards the fundus of small herniæ. By the knife's edge, held horizontally, the raised fold is cut. Through this aperture, the serous fluid in the sac flows out; while this is occurring, a probe-pointed bistoury is inserted, and the sac divided towards its neck, so as to admit the point of the finger; and, on this, as the best director, further dilatation of the opening is made to

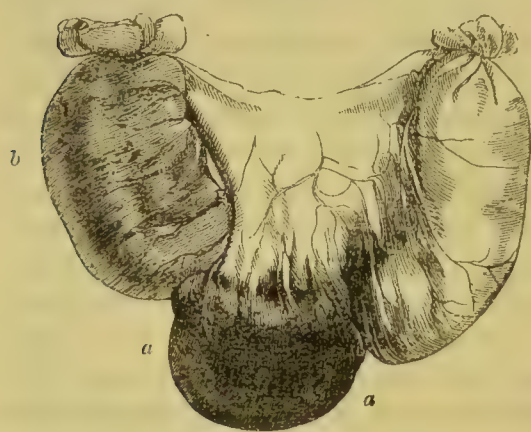


Fig. 311.

such an extent as may be deemed advisable. However large the hernia, the opening of the sac need not be of greater extent than what is merely sufficient for ascertaining the state of the contents, and permitting the finger to reach the site of the stricture. The point of the forefinger having been passed up to the abdominal aperture, the probe-pointed bistoury is slid flatly along it; and, by the point's edge, insinuated within, and then pressed upon the stricture, this is

notched to the necessary extent. The knife is then withdrawn, and the finger pushed gently onward, so as to dilate the opening; the knife being again introduced, if need be, to effect this more completely. Then the hernial contents, having been drawn gently downwards so as to expose the site of constriction, are replaced cautiously, if sound and reducible, portion by portion—the last protruded, first. Sometimes a considerable quantity of clear, bloody, or turbid serum escapes from the cavity of the abdomen. This usually indicates the existence of some peritoneal irritation; and the more complete the departure from the normal characters of healthy serosity which the fluid presents, the more unfavourable should be the prognosis. Recent and tender adhesions may be gently broken up with the finger, or touched with the edge of the knife; but consolidated adhesions, if at all extensive, usually render the parts irreducible, as they do not admit of being interfered with. When there is any considerable portion of omentum in the sac, it should be carefully examined, to ascertain whether or not it conceals—perhaps strangles—a knuckle of intestine. If the sac be not adherent, it is replaced as well as its contents, but not along with them; for reduction is found to be facilitated by an assistant's finger steadying and stretching the sac, while the contents are pushed upwards on its smooth and slippery surface. Reduction having been accomplished, the wound is brought together by

Fig. 311. *aa*, The portion of bowel which has been protruded; constricted, dark, and engorged. At *b*, the upper, or cardiac portion, dilated, and of dark colour. At *c*, the lower portion, comparatively empty, flaccid, and pale.

sutures, and suitable pressure applied by a pad and bandage. Approximation by suture should not be too accurate, however; for union by adhesion is not always desirable, otherwise danger might accrue from retention of the inflammatory products formed either in the deep wound or within the peritoneal cavity. They should be allowed a free outward drain.

When hernia is irreducible, we content ourselves with division of the stricture. If the contents are sound, the external wound is approximated with a view to adhesion. If the contents are found gangrenous, or verging thereto, the wound is left open, to permit free discharge of the fæculent contents.

If on exposing the contents of a reducible hernia, the bowel be found merely congested—ruby or chocolate coloured, it may be—perhaps spotted by points of ecchymosis, or showing one or more vesicles of the peritoneal coat—it is reduced unhesitatingly. If showing signs of plastic product on its surface, it may still be reduced; no structural change has taken place but what may be recovered from. But if the bowel be dark-purple at some parts, greenish at another, and perhaps ash-coloured at a third, friable, and from the odour evidently fast passing into gangrene; or if at the part nipped by the constriction, the ulceration proceeding from within has nearly divided the intestinal coats—it must not be reduced; else fatal fæculent extravasation will ensue. And if the contained omentum be found dark-red, emphysematous, and with its venous blood coagulated, it too must be left to slough in its outward site; in either case, however, as much care being taken to free the neck of the tumour by division of the stricture, as if the whole were fit for reduction. In the case of gangrened bowel, it is also well to incise the sloughing part, so as to afford relief by immediate and copious fæculent evacuation; afterwards introducing a single point of suture to keep the aperture of the bowel in contact with the integumental wound. Subsequently, the treatment is as already described for artificial anus. In the case of gangrenous omentum, two modes of procedure are in our option. We may cut off the dead portion, having previously satisfied ourselves that there is no portion of bowel within the mass, secure the vessels by fine ligatures, and return all within the abdomen. Or, having cut off the gangrened part, and secured the bleeding points, we may leave the rest still impacted in the abdominal outlet, with the view to its becoming permanently fixed there, and so preventing all future tendency to protrusion. The former method—though not free from risk by bleeding and inflammatory change within the abdominal cavity—is usually preferred; the latter being often followed by uneasy sensations in the part, and proneness to abdominal disorder.

In all cases of doubt as to viability of the strangulated parts, reduction should at least be delayed. It is never to be forgotten, that notwithstanding relief and replacement, inflammatory disease may still advance in the bowel, so as to cause loss of continuity by ulceration. And if this take place within the abdomen, and be followed by fæculent escape, before adhesion of the bowel to surrounding parts directs the fæcal flow to the surface, the patient's doom is sealed.

Sometimes, after opening the sac, stricture at the ordinary sites is sought for in vain. In such cases it is likely to be found in the hernial contents themselves; a portion of omentum, for example, may encircle a portion of bowel. This is detected by careful manipulation; and is to be gently undone by the fingers, perhaps aided by a touch of the knife. After all constriction has been relieved, the protruded parts will sometimes resist the best directed efforts at reduction. If this is not due to adhesions to the sac, it may be produced by agglutination of parts within, more especially to the parietal peritoneum close to the neck of the sac. The finger introduced within the abdominal cavity, and swept round the mouth of the sac, will usually detach such adhesion, and permit the ready return of the protrusion.

The effect of the operation is, in most cases, to afford immediate relief to the uneasy symptoms which previously existed. The vomiting and retching cease, the sunk collapsed state begins to pass off, the pulse becoming fuller, and, at the same time, soft; while the abdominal pain and tenderness gradually subside. The thirst ceases, the general surface becomes warm, and covered with a copious warm perspiration, and the patient either spontaneously or from an opiate, which should usually be at once administered after the operation, drops into a sound sleep. Sometimes the bowels act very soon after relief has been afforded; in other cases, not till a day or more has elapsed. In such favourable cases, rest and a simple non-stimulating diet are alone required, till the normal functions become restored; but no purge, however simple, should be given by the mouth, until many hours have elapsed—otherwise, as already stated, dilatation with obstruction will take place above the palsied portions of intestine, and the patient will probably sink under symptoms of ileus.

After operation, the greatest attention must be paid, for some days, to prevent reproduction of descent, by keeping the compress accurately applied, and avoiding the ordinary exciting causes. Should reprotrusion take place, by coughing, restlessness, or imprudence of the patient, the dressing must instantly be undone, and replacement effected. When the sac remains unreduced, simulation of re-descent is apt to take place, by serous accumulation within the sac; especially if the integumental incision be closed; but this state is at once detected and remedied, on opening up the wound. The patient should certainly not attempt to rise for any purpose, until the wound is so far healed as to admit of a well-fitting truss being worn, as in ordinary cases—seeing that the operation rarely effects a radical cure. Should tenderness of the abdomen, acceleration of the pulse, heat of skin, thirst, or drawing up of the limbs, with arrest of the diaphragmatic breathing, indicate the occurrence of peritonitis—hot fomentation, with leeching, or even bleeding, should be immediately employed; opiates being given in such doses as will lull pain and afford rest, perhaps cautiously combined—unless the state of the bowel should forbid it—with calomel, or some other preparation of mercury.* If the intestine previous to reduction have shown an ad-

* Dieffenbach is afraid of calomel; supposing that it acts injuriously on the bowel, and is apt to induce an unhealthy state of the wound.—*Vide* his *Operative Surgery*, 1848.

vanced stage of the inflammatory process, ulceration or other dangerous structural change is liable to ensue. In such cases, the inflammatory symptoms are very generally of an asthenic or typhoid type, and accompanied by diarrhoea. Blistering, or turpentine stupes, and hot poultices, with opiates and stimulants, and easily digested but simple nourishment—such as milk and beef juice afford—are more likely to be beneficial than more heroic procedure.

Oblique Inguinal Hernia.

This is by much the most common form of hernia, in the male. Descent takes place along the outer side of the spermatic cord, through the inguinal canal; the tumour shows itself external to the parietes, at the outer abdominal ring; and thence descends into the scrotum in the male—constituting an *oscheocele*, or scrotal hernia; into the labium of the female, constituting *labial* hernia; or still contained within the inguinal canal, and then called a *Bubonocoele*. The investments of the tumour are as follows: externally, the integument; then the superficial fascia of the abdomen; then the proper fascia, or fascia propria of Camper, consisting of the prolongation of the intercolumnar fibres upon the cord; then the fascia cremasterica, formed by fibres from the cremaster muscle; then the infundibuliform, or transversalis fascia, consisting of a prolongation of the fascia transversalis abdominis; lastly, the sac.

There are sub-varieties of inguinal hernia:—1. *The Intermuscular Hernia*.—This is more liable to occur in females than in males; the bowel meeting with obstruction in its ordinary descent. Having passed the internal aperture, it turns towards the ilium, and lodges between the abdominal muscular layers, above and exteriorly to its point of exit. On account of this unusual site, diagnosis may be somewhat obscure.*

2. *The Congenital Hernia*.—This is a very simple deviation from the normal state of parts; dependent on imperfect development. It is not likely to take place till after birth; for not until after inflation of the lungs are the exciting causes applied. But so soon as the child is born, the exertion of crying brings down a portion of bowel or omentum along the open process of peritoneum, which exists in consequence of that which constitutes the tunica vaginalis testis having not been occluded. There is no sac, except the tunica vaginalis; the bowel or omentum lying within the cavity of that tunic, in contact with the testicle—sometimes adherent to it, in which case the tumour is irreducible. Occasionally a portion of bowel contracts adhesions to the testicle while within the abdomen, and, descending with it at the usual time, constitutes this form of hernia before birth.

Protrusion may, however, occur at any period of after-life; we meet with it certainly most commonly in the infant, occupying both sides; but it may appear for the first time in the adolescent, or even in the adult; the communication usually having remained patent in these cases only upon one side.

3. *Hernia Infantilis*.—This term is applied to a more complicated state of parts. The communication between the tunica vaginalis and ab-

* Luke, Medical Gazette, March 15, 1850.

domen becomes occluded ; but the former cavity is unusually spacious, and ascends high in the cord, containing, it may be, more or less serous fluid. Behind this a hernia descends invested by its ordinary peritoneal sac. The infantile hernia has thus the serous sac of the tunica vaginalis lying in front and overlaying it.

As an inguinal hernia is about to descend, a painful fulness is found opposite the upper abdominal aperture, increased by abdominal exertion, and sustaining an expansile impulse upon coughing. Then is the time for applying a truss carefully, and avoiding exciting causes, with a view to prevention of the hernia. The pad of the truss should compress the superior abdominal aperture, not the lower ; otherwise there is room enough for hernia, and strangulated hernia too, within the abdominal parietes.

The diagnosis of the oblique form of inguinal hernia, from other affections occupying the inguinal region, is sometimes a matter of difficulty. While the tumour still occupies the inguinal canal, an *undescended testis* may simulate the bubonocoele, as this form of the hernial protrusion is called. The absence of the testis in the scrotum upon that side, the hardness and immobility of the tumour, and the peculiar sickening pain produced by pressure upon it, suffice in most cases to render the diagnosis

easy. When, however, the undescended testis is inflamed, as it may be, from the pressure of a truss which has been applied under the belief that it is a hernia, or when it has become acutely affected during the progress of gonorrhoea, the pain, sickness, and rapid increase in the swelling, may lead to a suspicion of the existence of a strangulated hernia. Still, the absence of the testis from the scrotum, and the history of the case, should in most instances save the practitioner from error. In one case of this kind, when the effusion into the tunica vaginalis, situated within the inguinal canal, had produced a protrusion at the external abdominal ring about the size of a nutmeg, I introduced an exploring trocar, and drew off about two ounces of serous fluid, with complete

relief to the acute symptoms from which the patient was suffering.

Hydrocele of the Cord may closely simulate a bubonocoele. In some cases the protrusion recedes on pressure ; and so long as a truss is worn, or digital pressure is applied to the internal ring, it does not again appear, but at once becomes prominent as soon as the pressure is removed ; in other cases, it slowly retreats when the patient is recumbent, and only becomes full when he has walked about for some hours—while the pressure of a truss has no effect in restraining it. In the former case there is a cyst within the abdomen, the extremity of which constitutes the protrusion ; in the latter, the fluid is either contained among the elements of the cord, and constitutes a dropsy of the cord, or gravitates into the partially occluded communication which origi-



Fig. 312.

Fig. 312. Diagram illustrating the state of parts in hernia infantilis.—LASTON.

nally existed between the abdomen and tunica vaginalis testis. In the first example, the peculiar elastic resilience of the cyst, with sometimes the easy recognition of a continuous and larger cystic swelling above the internal ring, will serve to determine the nature of the tumour. In the second, the gradual accumulation of the contents when accurate pressure is kept up over the site of the internal ring, will indicate its true nature. Both these forms of hydrocele of the cord may protrude beyond the external ring, and may be recognised by the same characters. The partial or complete communication between the tunica vaginalis and the cavity of the abdomen may permit the escape, not only of fluid, but alternately, or at a later period, of a true hernial protrusion; thus rendering the diagnosis still more beset with difficulty, which only repeated examination can satisfactorily overcome.

Iliac abscess, making its way to the surface by the inguinal canal, very closely simulates a hernial protrusion; but, like a hydrocele of the cord, which communicates with the abdomen, may be distinguished by the insufficiency of pressure to retain the protrusion when the patient occupies the erect posture.

Encysted Hydrocele of the Cord, within the scrotum, may be recognised by its round or oval form, its definition above and below, the peculiar fibrous feeling communicated to the fingers on pinching the sac between the finger and thumb; and from the absence of impulse on coughing either in the swelling or at the site of the internal abdominal ring.

Hydrocele of the tunica vaginalis can always be distinguished from a hernia by manipulating the cord at the external abdominal ring, so as to recognise the absence of any protrusion along with the elements of the cord, and by ascertaining the position of the testis. When, however, the communication between the tunica vaginalis and abdomen remains patent, the difficulty in diagnosis becomes increased; and in such circumstances it is well to remember that while both the fluid accumulation and a hernial protrusion may co-exist, the former cannot be restrained by a truss, while the latter always can.

Varicocele is distinguished from a scrotal hernia by the compressible yet doughy character of the swelling, which, when pinched between the fingers, resembles a bag filled with worms. On laying the patient recumbent, the swelling disappears more or less completely, but becomes again distended from below upwards on the patient standing, and that while pressure is accurately and firmly maintained over the abdominal ring. The dilatation of the abdominal opening, which results in some cases of varicocele, may predispose to the occurrence of hernial protrusion. In some cases, therefore, we find these conditions co-existent.

Tumours of the testicle can scarcely be mistaken for hernia, unless, indeed, in medullary disease, when the cord is involved, and a thickened mass extends into the abdomen. The character of the swelling, the complete implication of all the elements of the cord, and the history of the case, should preclude all risk of error.

The diagnosis of the different varieties of oblique inguinal hernia from each other, is no easy matter in many cases. It is therefore fortunate that such distinction is unimportant in treatment.

The *intermuscular* form is not likely to be mistaken for anything, except, indeed, a femoral hernia which has turned upwards, and lies along the line of Poupart's ligament.

In the ordinary oblique scrotal hernia, the testicle occupies the lower part of the swelling. In the infantile it holds the same position; but in the congenital, the position of the testis is as in a case of hydrocele of the tunica vaginalis.

When an oblique hernial protrusion has existed since childhood, the inference that it is of the congenital variety is usually justified, especially if it exists upon both sides. As we have already said, however, the congenital variety may occur in the adult or adolescent, although protrusion have never taken place in early life.

To reduce the oblique form of inguinal hernia, the pressure of the taxis is applied obliquely upwards and outwards, in the direction of the inguinal canal. In large tumours of old standing, however, it must be remembered that the canal becomes shortened as well as more direct—the two apertures coming to be almost opposite to each other; and this is attended to in the taxis. In order to relax Poupart's ligament and the abdominal parietes, the patient is laid recumbent, with the trunk raised, and the thighs flexed and approximated.

Radical Cure of Oblique Inguinal Hernia.—Various methods have at different times been resorted to with the view of attaining this very desirable end. Till recently, however, none of the measures, however much vaunted they might be for a time, secured the good will of the profession, except the employment of a well fitting truss in the case of herniæ occurring in young children. In some cases, accordingly, at the present day, every indication will still be fulfilled by this simple apparatus. The results which it is desired to secure by such use of the truss are twofold—1st. Support applied so accurately and constantly at the internal abdominal ring as to prevent protrusion, and admit of the gradual spontaneous closure of that aperture by the muscular and fibrous textures which surround it. 2d. To effect such pressure upon the inguinal canal as shall occlude the serous sac and consolidate the parts.

These indications have been secured by different mechanical contrivances; of which L'Estrange's truss—or the oval boxwood truss, with powerful spring, as originally recommended by Richter, and latterly much employed by American surgeons—or the common cork pad, so modelled as to effect pressure upon the whole canal, but chiefly upon the internal abdominal ring—may be mentioned as having afforded the best results. The period during which the truss requires to be worn is considerable—ranging from one to three or more years. There is, however, the risk that such pressure upon the cord continued for so long a time, especially if the same system is attempted to be carried out in the case of the adolescent or adult, may endanger the function of the testicle, or set up inflammatory changes in the inguinal canal. Yet a happy result may accrue even from this. Thus, we have seen an abscess form under the pressure of a galling pad, point, discharge, contract, and heal, and so consolidate the outlet by the extent and situation of plastic product, as to render the further use of the truss quite unnecessary. To effect the

requisite degrees of compression, without, however, endangering the cord, Mr. Wood has recently invented an oval horse-shoe-shaped pad. The two limbs correspond to the two pillars of the ring, and embrace the spine of the pubes and the cord at their extremity. The rounded or oval upper part of the pad corresponds to the internal ring, while the pressure is so arranged by two C springs that the abdominal parietes at the inner and upper aspect of the internal ring obtain the chief support. "By the use of this pad," says Mr. Wood, "we have the boundaries of the hernial canal and openings supported and compressed by a flat surface, tending to resist outward and lateral dilatation, in exactly the same manner as the fingers of the surgeon. There is no dilating pressure on the axis of the canal whatever, and no invagination of the soft parts, as in the use of the convex truss pads. The whole of the canal is equably compressed, and the deep ring supported by the upper part of the truss."*

In the adult so fortunate an issue as a radical cure by such means is not to be hoped for; the rings remain partially dilated, and predisposed to admit of re-descent, on the application of but a slight exciting cause; the truss usually, therefore, must be worn for life. Sometimes, however, though rarely, a slight protrusion, which as yet only bulges the parietes at the site of the deep ring, may disappear under the temporary use of a truss, and not again return.

In the adult, various measures have been devised for restraining permanently the occurrence of protrusion and the descent of the hernia. Of these, two deserve mention:—1st, By the invagination of a plug of soft parts into the inguinal canal (Wützer, Rothmund, Sigmund, Syme, Wells, Davies, etc.) 2d, By approximation of the textures surrounding the deep ring, and appression and closure of the tendinous boundaries of the hernial canal from one end to the other (Wood).

The former methods consist essentially in invaginating a cutaneous mass, derived from the tissues of the scrotum by means of a wooden plug, retaining it there by means of a needle (Wützer) which passes through a channel in the plug and penetrates the integuments of the abdomen at a point as near the deep ring as possible; while, over this, attached to the handle of the plug and the projecting needle, is a wooden compressor by which the parts embraced between the plug and the surface are so squeezed as to render them adherent to each other by the inflammatory process thus excited. When this has been accomplished, the presence of the invaginating plug is no longer needed; it is therefore removed, and the parts supported and secured by means of a pad and spica bandage. Mr. Syme has simplified this procedure by substituting a piece of gum-elastic rectum bougie for the invaginating plug, and employing a double ligature which has been carried through the extremity of the plug as a means of retention. The ends of the thread are first introduced by means of a curved needle in a fixed handle—guided by the finger which has invaginated the skin—through the tendinous textures of the internal ring upon the inner and outer sides. By drawing upon the ends of the ligature, the plug succeeds the finger, and is retained by tying the ends

* On Rupture, by John Wood, F.R.C.S.

of the ligature over a roller bandage, so as to prevent them from cutting their way through the skin.

The great objection to these plans, and various modifications of them, is, that the canal, although occupied by a plug—which certainly for a time may prevent further protrusion—is not occluded ; and the internal ring, on its posterior and inner aspect, still remains unobstructed, so that a hernial protrusion, under any sufficient exciting cause, may again escape behind the invagination. Mr. Syme's operation, if properly performed, certainly tends to secure the patient against this risk better than Wutzer's method ; for by means of it the conjoined tendon and Poupart's ligament may be drawn together, and consolidated with the extremity of the invaginated tissues.

Mr. Wood has introduced, and extensively practised, an operation for the radical cure of inguinal hernia which combines the occlusion of the inner and outer rings with the approximation of the walls of the inguinal canal.* The operation requires for its performance a stout tumour-needle, its curve forming the segment of a small circle, with either strong waxed linen thread, or wire.

The operation by the linen ligature is as follows. The rupture having been completely reduced is retained by an assistant compressing the internal ring, if that is found necessary. The surgeon begins by dividing the skin longitudinally over the fundus of the sac, to an extent sufficient to admit his finger guiding the needle. The skin is then detached from the tissues beneath for fully an inch in every direction. The operator now introduces his finger at the opening and invaginates the exposed superficial fascia into the inguinal canal, till he can distinctly recognise the internal ring, the position of the cord, Poupart's ligament, the margin of the internal oblique, and the edge of the conjoined tendon. The needle is now passed along the finger, and, guided by the sense of touch, is carried upwards and inwards so as to pick up a considerable portion of the most prominent part of the margin of the conjoined tendon. The point is then carried outwards towards the skin, passing through those fibres of the abdominal aponeurosis which at the pubes constitute the internal pillar of the external ring. An assistant now draws the skin upwards and inwards until the cutaneous surface which naturally lies over Poupart's ligament is brought over the spot at which the needle projects—and there it is made to protrude. The assistant threads one end of the ligature through the eye of the needle, which is withdrawn carrying the ligature along with it. The needle is now guided by the finger against Poupart's ligament, upon the level of the outer margin of the internal ring ; and as it is carried outwards the skin is drawn downwards and outwards, so as to enable the surgeon to bring out the point of the needle at the same cutaneous aperture. Here the loop of ligature is secured, and the needle withdrawn. The finger of the operator is next transferred to the external abdominal ring, and carried upwards and backwards immediately above the spine of the pubes, till he feels the margin of the rectus tendon and the resistance of the conjoined tendon. The needle is then passed along the finger, and carried outwards through the abdominal aponeurosis, so as to include a considerable

* *Medico-chirurg. Trans.*, vol xliii., 1860 ; also, Wood on Rupture, 1863.

extent of its textures above the internal pillar of the external ring. The skin is drawn inwards and downwards till the point of the needle can be made to protrude at the aperture from which the one extremity and loop of the ligature already hang. The thread is then freed from the eye of the needle, and the latter finally withdrawn. The ends of the ligature and the loop are now tightened up, the surgeon's finger being at the same time introduced within the canal to appreciate the approximation of the posterior to the anterior walls of the canal, and the completeness of closure of the external abdominal ring. A compress of lint, or a roller bandage, is then laid on between the loop and the ends of the ligature, in the axis of the inguinal canal; and one end of the thread, having been passed through the loop, is tied firmly to the other in a slip-knot. Pads of lint are placed on either side of the compress, and the whole supported by a spica bandage.

The operation by wire, in preference to the one by ligature, is now usually preferred; and the wire best suited for this operation is made of copper, electro-plated with silver, of the size of No. 20 of the draw-plate.

The first part of the operation is precisely the same as that already described, and secures the margin of the conjoined tendon. As the needle is withdrawn, the wire is carried along with it. The needle, having been disengaged, is again passed so as to secure the outer side of the internal ring close to Poupart's ligament, and having protruded at the same cutaneous opening is withdrawn along with the other extremity of the wire, thus leaving a loop of wire projecting at the middle of the groin. The surgeon now carries the unarmed needle through behind the sac and in front of the cord, pinching up the former textures in the oblique incision in the scrotum, close to the external ring, and having inserted one of the ends of the wire which emerge from the aperture, into the eye of the needle, they are withdrawn together. When the hernia is small and recent, both pillars of the ring may be included in the last-mentioned course of the needle. The ends of the wire are now drawn upon, until the loop above is in close proximity to the skin. An assistant retains it here till the surgeon twists the free extremities of the wire together a few times, the loop is then drawn upwards and twisted a like number of times in the same direction, the surgeon introducing his finger into the scrotal opening to ascertain that the canal and external ring are satisfactorily closed; the ends of the wire are then passed through the loop over a compress, and, having been suitably abbreviated, the whole is supported by means of a spica bandage. After either operation the patient should be confined to bed, and so laid as to relax the abdominal parietes as completely as possible, and at the same time support the scrotum. An opiate should be administered, and the patient kept for the first few days on milk diet. There is usually no need for any movement of the bowels for four or five days, if they have been evacuated by means of castor oil before the operation—and then only if the patient feels uneasy or is troubled with tympanitic distension. The ligatures should be untied and removed at the end of from three days to a week—and the wire untwisted and withdrawn, through the upper aperture, at the end of from one week to a fortnight or even three weeks—regulating this

period by the degree of thickening induced, and the original size of the dilated inguinal openings. There is seldom much discharge ; that from the lower opening is usually the more copious and persistent. The part should be dressed daily with dry lint, charpie, water-dressing, or red lotion, as the condition of matters seems to indicate—the compress and spica bandage being always continued till the parts have soundly cicatrized. The patient may perhaps leave his bed before this, and lie upon a couch, or even sit up. Walking about, however, tends to delay the healing process, and should not be permitted till all is cicatrized. Then, when the patient can bear it, a truss with the horseshoe pad should be carefully adjusted and worn for a longer or shorter period.

Mr. Wood further practises variations in the wire operation to suit special conditions in cases coming under treatment.

Thus he sometimes removes an elliptical portion of the redundant scrotal integument. In other cases, where the sac and hernial canal are unusually long, he secures a greater degree of upward traction upon the scrotal tissue and sac by forming the loop below instead of above. This is effected as follows :—the first puncture and withdrawal of the wire are executed as in the ordinary procedure, the needle is then passed behind the sac and in front of the cord, and the wire drawn through ; then, instead of unhooking the wire from the eye of the needle, he carries it armed up the canal, and through the fibrous tissue above the middle of Poupart's ligament on the outer side of the deep ring. The two free ends of the wire thus protrude at the upper opening, the loop hanging out below. As the ends are drawn upwards and outwards, the loop and the scrotal textures follow ; the wire therefore embraces and approximates, as its ends are twisted together or drawn over a wooden pad, the conjoined tendon and the middle of Poupart's ligament with the two pillars of the ring, compressing them against the superficial fascia of the scrotum and the sac which are drawn within the canal. In cases, again, where the openings are widely dilated, after the ends of the wire have been passed in the ordinary way, both ends are made to cross behind the sac and in front of the cord, one extremity being passed by the needle, then unhooked, and the other withdrawn along with it. Afterwards, the unarmed needle having been carried behind the inner pillar of the ring, the inner extremity of the wire is withdrawn along with it. The needle is then passed through the outer pillar of the ring, and the outer extremity of the wire withdrawn by its means. Twisting of the wire is conducted as usual.

Other modifications of this operation are also practised by Mr. Wood by means of pins with rectangular shanks ; and are peculiarly suited to the radical treatment of congenital rupture in young children. These methods certainly exceed all others in ingenuity of contrivance and excellence of principle. They have been employed, however, during only four years, and are therefore hardly sufficiently tested in practice to enable the profession to pronounce final judgment on them. In most patients, in the better ranks of life, a well-fitting truss is capable of supplying the deficiency in retentive power which exists in the walls of the abdomen. It is, therefore, *chiefly* in the working classes and labouring men, that some such radical plan of treatment is required ; and should

such methods of effecting a radical cure enable them to do without a truss, or to retain with a truss a hernial protrusion which previously was found to be unrestrainable, a very great boon will certainly have been conferred upon such sufferers.

In the operation for strangulation, on account of oblique inguinal hernia, a simple straight incision is made along the neck of the tumour ; beginning a little above the external abdominal ring, and extending downwards on the swelling, as far as may be deemed necessary. The textures are cut through in the order previously enumerated. Very frequently, especially in recent cases, the division of the intercolumnar fibres between the pillars of the external abdominal ring at once relaxes the constriction, and admits of the return of the hernial protrusion without opening the sac, should the other circumstances of the case make this desirable. Beyond this part, the mouth of the infundibuliform fascia forms the most common site of constriction, either external to or within the sac ; but sometimes it is found in the conjoined muscular fibres or tendon. And in some cases a double strangulation occurs ; one at the

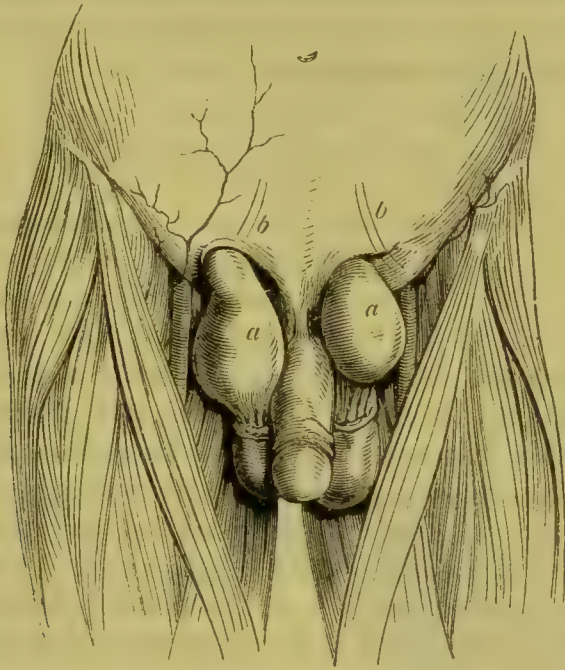


Fig. 313.

external opening, the other deeper. In any of the deep-seated sites of stricture, the incision for its relief should be made directly upwards, in order to avoid the epigastric artery, which courses behind and to the inside of the neck of the sac, as it passes from its origin from the external iliac at the middle of Poupart's ligament, upwards and inwards, to enter the sheath of the rectus muscle. The spermatic cord is usually behind, and to the inner side, and out of harm's way ; but sometimes it is split up and scattered over the neck of the hernia—and then caution is required, to avoid the spermatic artery and vas deferens. In operating, in cases of strangulation, upon the *congenital* form of hernia, no peculiar feature is observed in the procedure ; on opening the sac, however, the

Fig. 313. Plan of inguinal hernia ; on the right side oblique ; on the left direct. *a*, The hernial sac ; *b*, the epigastric artery.—After TIEDEMANN.

surgeon may have his attention directed to the presence of the testis projecting into its posterior and lower part. It is otherwise in the operation for the *infantile* variety ; for in cutting down, the surgeon may be much embarrassed by meeting first with one serous sac—the tunica vaginalis—through which he must pass to reach the hernial sac, which lies beneath. In some instances there may be some thickness of areolar tissue, or even the elements of the cord interposed ; more usually, however, the two serous sacs are incorporated.

It is to be remembered, that within the inguinal canal, a small strangulated hernia may exist with scarcely any perceptible swelling ; a minute portion of bowel being tightly embraced by the margins of the superior abdominal ring. The symptoms are likely to be mainly those of enteritis, and attention may not be directed to the groin. In such circumstances the patient has great risk of perishing ; unless by sloughing and abscess outward discharge occur, with establishment of artificial anus. In all such cases where, besides the localised pain, the presence of a tumour, however small and indistinct, and the existence of urgent symptoms concur, an exploratory operation should be undertaken ; and in such circumstances the relief of a strangulation has often afforded the best proof of the propriety of interference.

Ventro-inguinal Hernia.

This is also called the *Direct* (Cooper) or *Internal* (Hesselbach) inguinal hernia. Descent is unconnected with the superior abdominal ring ; and takes place through the abdominal parietes, immediately or nearly opposite the external abdominal ring. The protrusion occurs in the triangular space (Hesselbach), bounded on the inner side by the outer margin of the rectus, externally by the epigastric vessels, and inferiorly by the inner half of Poupart's ligament. This triangular space, however, is divided into two unequal halves by the remains of the obliterated hypogastric artery. The ordinary form of *inferior direct* inguinal hernia protrudes through the lower of these parts, which lies between the obliterated hypogastric vessel and the margin of the rectus. The less common form, or *superior direct* inguinal hernia, protrudes through the portion of the triangle which lies between the epigastric artery and the hypogastric vessel. In the former, the protrusion, covered by the sac and transversalis fascia, either lacerates or dilates the conjoined tendon, and passing through the external abdominal ring, with the cord to its outer side, acquires a covering from the intercolumnar fascia. In the latter, the protrusion passes close to the inner side of the epigastric vessels, beneath the margin of the internal oblique and transversalis. Here coming in contact with the cord, it acquires a partial cremasteric covering, but still has the cord to its outer side. This form of hernia would therefore have the same coverings, and somewhat the same aspect, as the oblique inguinal hernia ; but would differ from it in having the epigastric vessels to the outer side of its neck, and the cord upon its outer instead of its posterior aspect.

In making efforts at reduction, the same measures already described as suited to the oblique form of hernia are essential here. The direction

in which the taxis is applied should, however, be more directly upwards and backwards. In employing retentive measures, the pad of the truss should press directly upon the external abdominal ring. There is, therefore, no necessity for any obliquity in the form or position of the pad, which should be round and flat upon the surface. A Salmon-and-Ody truss will usually be found better than the common bandage, in this form of rupture. Mr. L'Estrange has contrived an ingenious form of truss for the direct inguinal hernia, in which the pressure acts from below upwards. Mr. Wood recommends, especially for cases where an operation for the radical cure has been practised, that the pad should have an ovoid form, with a nearly flat surface and a central aperture. The action of this truss is calculated to approximate the borders of the external opening, while, by its adaptation to the form of the groove in the groin, it is less liable to be displaced than the common instrument.

The same radical operations, by invagination of the cutaneous tissues, or by subcutaneous wire suture, as recommended by Mr. Wood, are suited to this situation.

In operating for relief of strangulation, the course of the epigastric artery, to the outer side of the neck of the tumour, should be borne in mind (Fig. 313). And in all cases of inguinal hernia, especially when strangulated—as the diagnosis between the direct and oblique form may be doubtful—it is a prudent rule to make the deep relieving incision directly upwards, parallel to the linea alba; so, whatever the form of rupture, the artery is safe.

Femoral Hernia.

This is most frequent in females; the greater space, in the normal state of the parts, obviously favouring protrusion. Descent takes place through the crural aperture, within the inner compartment of the femoral sheath, and the protrusion becomes superficial by bulging forwards through the saphenous opening of the fascia lata. The neck of the tumour is contained in the crural aperture; the fundus, resisted in its descent on the thigh, makes a sharp turn upwards, and lies on the lower part of the abdominal parietes; the neck is beneath Poupart's ligament, the fundus may be above it, directed obliquely upwards towards the anterior superior iliac spine. And this must be attended to in applying the taxis; the tumour being invariably drawn downwards, and the fundus and neck brought into the same axis, ere the



Fig. 314.

Fig. 314. Plan of femoral hernia. *a*, The sac; *b*, the femoral vein; *c*, the artery; *d*, the abdominal ring; *e*, section of the psoas and iliacus muscles; *f*, the acetabulum. —From DRUITT.

reductive pressure is applied. The tumour is usually of small size ; often not bigger than a pigeon's egg ; sometimes it is of even huge dimensions ; but its average bulk is much below that of the inguinal varieties. The coverings are—integument ; the superficial fascia of the thigh ; the cribriform fascia ; the fascia propria, consisting of the femoral sheath which is a continuation of the fascia transversalis and fascia iliaca ; lastly, the septum crurale, a covering obtained from the textures which normally occupied and occluded the crural aperture. Very often the two last named coverings are matted together, into one dense fascia ; and thus we may expect occasionally to meet with but two investing layers ; one the superficial fascia ; another beneath it, deep, dense, and strong. Not unfrequently the deep layer splits at its lower part ; and the fundus of the tumour, emerging through the aperture, may be covered only by the superficial fascia and integument.

Diagnosis of Femoral Hernia.—Tumours occurring in this situation are liable to be mistaken for hernia. Swollen and tender glands, especially if suddenly enlarged and accompanied by abdominal uneasiness or vomiting, may be mistaken for a strangulated rupture. This is more especially the case when the gland occupies the femoral canal. The elongated form of the swelling, the presence of other glands similarly enlarged, the existence of a cause sufficient to account for the swelling, and the history of the case, should usually prevent error. When, however, the glandular swelling is large and symptoms of strangulation are well marked, while no protrusion can be detected at any of the other ordinary sites of rupture, an exploratory operation should certainly be

undertaken to determine the nature of the swelling, and to decide whether or not a strangulated hernia lies beneath. *Psoas* or *Iliac* abscess sometimes points to the inner, instead of upon the outer side of the femoral vessels, while a pelvic abscess may even make its way to the surface through the crural canal. The spontaneous recession of the fluctuating swelling, on the patient assuming the recumbent posture, and its reappearance in spite of steady pressure made over the aperture of emergence—along with an inquiry into the presence of other symptoms, and into the history of the case—will usually save the practitioner from mistake. *Varix of the Femoral Vein*, or of the

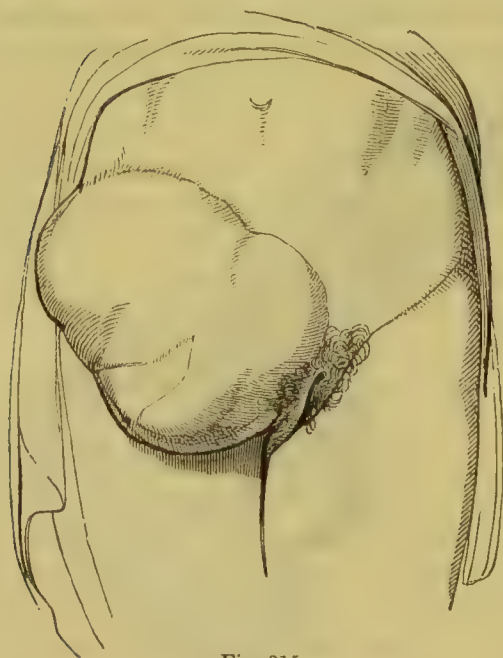


Fig. 315.

Saphena.—The reduction and flaccidity of the swelling under pressure and in recumbency, and its reproduction and tension in spite of firm pressure applied over the femoral outlet when the patient stands erect, will indicate that the affection is not a hernial tumour. *Cystic tumours,*

Fig. 315. Femoral hernia ; of unusually large size.

or *fatty tumours*, may occur in this region, and if the presence of a soft elastic swelling were alone regarded, might occasion some difficulty in diagnosis. A much more important and sometimes difficult matter for diagnostic acumen, is the determination of whether the hernia is a small inguinal one contained within the inguinal canal, or a large crural rupture which has evolved itself upwards and outwards along the line of Scarpa's fascia. The distinction must depend chiefly upon the position of the neck of the tumour with reference to Poupart's ligament and the spine of the pubes; the neck of the crural rupture lying below these points, the neck of the femoral above them.

There are two peculiarities in applying the taxis to this hernia. The position of the patient is as for the inguinal; but with the limb on the affected side bent much upwards, and at the same time carried across its fellow, so as to relax the crural arch, on which, and not on Poupart's ligament, constriction depends. The pelvis, too, may be alternately raised and depressed. Also, as already stated, the fundus of the tumour must be drawn down and straightened on the neck before reductive pressure is attempted; in other words, the tumour is first drawn downwards and inwards on the thigh, and then pushed upwards into the abdomen. After reduction, a well made truss is applied; the pad resting on the outside of and beneath the spine of the os pubis.

For this purpose a small ovoid or triangular pad, fitting into the saphenous opening, should be employed; the central part flattened, the upper extremity broad and bluffly round, while the surface of the lower extremity or angle should be obliquely sloped away. The upper part rests on and compresses Poupart's ligament; the lower occupies the saphenous opening, while the centre acts upon the crescentic margin of the fascia lata, which forms the anterior wall of the crural canal (Wood).

Radical Cure of Femoral Hernia.—Mr. Redfern Davies of Birmingham has employed a modification of Wutzer's operation by cutaneous invagination in a case of femoral hernia, with the view of obtaining a radical cure. Others have recommended and employed wire setons introduced through the sac into the abdomen, and carried out through the textures above Poupart's ligament, in the hope of obtaining fibrinous product and adhesive results. Mr. Wood recommends a subcutaneous operation by means of wire, analogous to that employed by him in the cure of inguinal hernia. An incision about an inch in length having been made over the saphenous opening, the fascia is detached, and the finger carried up as high as the crural opening, pushing before it the coverings of the sac. The pulp of the forefinger is now pressed against the femoral vein, to keep it out of danger, while the needle is passed backwards so as to take up the pubic portion of the fascia lata internal to the line of the saphena vein, and is carried outwards through Poupart's ligament to the inner side of the invaginating finger; an assistant now draws the skin outwards, the needle is brought out upon the surface, and as it is withdrawn, the wire hooked through the eye is lodged in the needle-track. The unarm'd needle is again passed; this time taking up the fascia over the pectineus, about three-fourths of an inch or an inch from the first puncture, and is carried onwards through the inner portion of Poupart's ligament, including a part of Gimbernat's—again

protruding through the skin by the same puncture as on the first occasion. The opposite end of the wire is now withdrawn. The two ends which thus hang out at the incision in the groin are first drawn upon and twisted firmly together; and then the loop, which projects above Poupart's ligament, is twisted down into the puncture, so as to approximate and close the extremities and boundaries of the crural canal. The ends of the wire and the loop are then fastened over a pad of lint. Or the upper extremity of a compress of wood, or a roller bandage, having been introduced within the circle of the loop, the ends of the wire are drawn firmly downwards, and secured over the lower end of this. Support by means of a spica bandage, and the same after-treatment as in the radical cure of the inguinal hernia, are to be adopted.

Strangulation is both more common and more severe than in the inguinal forms of hernia; and consequently operation is more frequently required. It is performed thus:—The skin, having been pinched up, is divided by transfixion; in order that there may be no risk of injury to the important parts beneath. The form of this integumental wound may be greatly varied; an inverted T; an inverted Y; a V; a simple oblique cut; or, as shewn in the accompanying diagram—

The investing textures are cautiously divided, by means of the forceps and knife—the latter held horizontally; and the sac is exposed. In many cases the opening of it cannot be avoided. And, this having been done, the forefinger of the left hand is passed up to the neck of the tumour. Here, as in the oblique inguinal hernia, there may be two strictures, a superficial and a deep. The former is considerably anterior to the ligament of Gimbernat, and independent of it; formed by the inner and anterior part of the crescentic portion of the crural arch; felt tight, on the inside of the tumour's neck, while the finger's point is yet at some distance from the actual brim of the pelvis. This resistance is divided by a probe-pointed bistoury—slid flatly along the finger, and afterwards having its edge directed upwards and inwards. Dilatation is then made by the finger; and, on withdrawing this, reduction may be effected, readily.

If not, the finger is re-introduced; and, pushing it upwards, Gimbernat's ligament and the crural arch are felt tight and resisting, on a deeper level than the former site of constriction. They are divided in a similar way; the bistoury's point being barely insinuated within the margin of the stricture; the least movement of its blade suffices; a notch in the edge of the ligament is enough; and the finger, following, dilates. Were the deep incision to



Fig. 316.

Fig. 316. Portion of bowel, not including its whole calibre, which was caught and strangled at the crural aperture; the symptoms, though modified, proving fatal. During life, no tumour could be discovered at the site of protrusion.—LISON. His Elements, p. 535.

be made directly upwards, Poupart's ligament might be divided—an unnecessary act, that texture being unconnected with the constriction ; and, besides, the spermatic cord in the male, and the round ligament in the female, would then be endangered. If the obturator artery arise by a common trunk with the epigastric, it is likely, passing downwards to its destination, to encircle the neck of the sac within the pelvis. And were the bistoury, which divides the higher stricture, to be used rashly—without the guard of the finger, and with any part of its blade thrust over the brim of the pelvis—this vessel would doubtless run no slight risk of being wounded. But, with ordinary precaution—the forefinger preceding the knife, and merely the bulbous point of the latter passing within the pelvic brim—the vessel is safe, whatever be its distribution. To make assurance doubly sure, on this point, it has been proposed to use a knife wholly blunt in the edge. This pressed upon the tight resisting fibres may dilate or tear them, while the elastic artery escapes all injury.

In the extra-peritoneal operation, a smaller wound suffices than in the ordinary method. It is placed on the inside of the tumour, at its upper part ; and by means of it we may have it in our power to relieve the stricture without any interference with the hernial sac. Should this fail, and there be reason to suspect that the stricture is in the sac itself, it is necessary to enlarge the wound, disclosing the parts more thoroughly ; and then we may attempt relief by scratching through the faulty external fibres, as in inguinal hernia. Failing this, the sac is opened, and the operation completed in the usual way. The after-treatment is as for the inguinal operation.

It is in strangulated femoral hernia that we are most liable to be puzzled, as to the exact nature of the tumour. But the safe general rule, as formerly stated, is to operate when in doubt.

Umbilical Hernia.

This is common in infants ; and in women who have borne many children, it is not unfrequent. In the former it very readily occurs ; the exertion of crying forcing the bowel or omentum outwards, through the yet unconsolidated umbilicus ; forming a soft, impulsive tumour ; at first of small size, not larger than a button—commonly called “a starting of the navel.” In women, unless congenital, it is seldom a true umbilical hernia ; protrusion having taken place near, not through, the navel, in consequence of a yielding of the abdominal parietes there, probably during parturition. Strangulation is comparatively unfrequent. In the adult, the tumour may attain to an enormous size.

In the child, treatment is both simple and effective. The exciting causes—especially crying—are averted, as much as possible. And compression is made by means of a flat pad—such as a piece of cork, or metal, covered with wadding or soft leather—which is made to occupy the surface from which the protrusion escapes, and is retained in its place by the child's belly-band, by strips of adhesive plaster, or by means of a belt of elastic material. This simple contrivance is more effectual than any truss or belt—being much less likely to slip ; and it has the equally

important advantage of not dilating the aperture as a conical pad would, nor of acting as an excitant of protrusion elsewhere. In the course of a year or two—it may be of months only—the parts are found consolidated, and further use of the compress is unnecessary. Mr. Wood employs in these cases a circular ring of india-rubber or gutta-percha, with the aperture occupied by a thin layer of india-rubber, or by a piece of adhesive plaster; the whole being retained by means of an elastic strap attached to the pad and carried round the abdomen.

In the adult, the case is not so easily managed. The tumour is larger and less repressible. A corresponding compress is necessary, secured either by a belt or by the spring of a truss. Its use is merely palliative.

Radical Cure of Umbilical Hernia.—Two methods have been had recourse to for this purpose. That recommended by Mr. Wood, and practised by him in three cases of obstinate umbilical rupture in children; the other employed in the case of an adult patient by Dr. P. H. Watson. Mr. Wood employs a spoon-shaped spatula, by means of which he invaginates the skin and sac through the aperture in the tendinous texture beneath. He then carries its extremity upwards and outwards, so as to bear it firmly against the under surface of the tendon. In the hollow of the spoon the needle is now passed through the skin, sac, and tendinous margin, till it appears beneath the cutaneous surface, which is drawn upwards by an assistant, so that the skin may be pulled as far as possible from a point below the aperture in the tendon. This is repeated on the same side at the lower end of the opening, taking care that the wires emerge through the same lateral aperture. A needle is again introduced through the cutaneous tissues and sac towards the opposite side of the hernial ring; entering the needles at the two original punctures, and carrying them outwards towards the other side. In this way two wires, entering by the same aperture on the one side, and emerging by the same aperture on the opposite side, include the tendinous margins of the opening. By twisting each pair of wires into the punctures, the hernial aperture is felt to be completely closed. Dr. Watson carries a needle in a fixed handle circumferentially backwards and forwards through the tendinous margin of the umbilical opening, first upon the one side and then upon the other; and, in withdrawing the needle, carries back, along with it, the extremities of a piece of stout silver wire. The ends of the wire, at one point of emergence, are tightened up by being twisted together; and the loop at the other extremity is then drawn upon and twisted into the aperture of emergence of the needle-point. In passing the needle, the finger invaginating the sac and its coverings enables the operator to guide the point with accuracy and safety. A pad and bandage should be applied and retained till consolidation is effected, or till effusion into the sac, which sometimes ensues, renders its presence irksome.

When strangulation occurs in umbilical hernia, relief is obtained in the ordinary way; by taxis, or by operation. The external wound need not be of large dimensions; most frequently, the hernial contents are found to have no coverings but the integument and the sac. The deep incision for relief of constriction, made by a probe-pointed bistoury on the fore-finger, is placed on the mesial line, usually on the lower aspect of the swelling. The taxis is made directly backwards.

The other varieties of Hernia.

Ventral hernia is a protrusion at any part of the front and sides of the abdominal parietes, except the navel and groins; the result of a giving way at some unusual point, in consequence of bruise, wound, abscess, or muscular rupture. There are no peculiarities in the tumour or its treatment; excepting that, as in most cases of the last mentioned variety of hernia, but few fasciæ need be expected to invest the sac. A *Perineal hernia* is said to exist, when bowel or omentum, with its sac, descends between the bladder and rectum, and presents itself as a swelling in the perineum. The term *Vaginal* is applied when, in the female, the tumour does not reach the perineum, but bulges into the vagina. Descent has also taken place through rupture at the fundus of the uterus. The *Diaphragmatic* or *Phrenic*, and the *Ischiatic* forms of hernia—protrusions through the diaphragm and the ischiatic notch—are fortunately rare. They do not admit of accurate diagnosis in life; and are not amenable to surgical treatment, if strangulated—unless the history of the case happen to be so unusually plain as to warrant incision. The *Obturatorial Hernia*—projecting through the foramen ovale—may be both discovered and relieved. In one case, occurring in the practice of Roeser of Bartenstein, a painful elastic tumour over the foramen ovale was reduced by the simple taxis, with complete relief to all the symptoms of strangulated hernia.

The *Hernia Litrica*, as noticed by M. Littre, is said to exist when the protruded viscus is a diverticulum of bowel, not a portion of the normal calibre of an intestine. The diverticulum may be congenital; a mere prolongation of bowel, consisting of all the normal coats. Or it may be of recent occurrence, formed by a protrusion of the mucous membrane of the intestine through its muscular coat, and consisting of the mucous and peritoneal coats alone. Both forms, the *diverticulum acquisitum* as well as the *diverticulum congenitum*, are liable to hernial protrusion; the former found only at the crural aperture, and always of slow formation (Fig. 316). This form of diverticulum being made at the expense of the main bowel, the calibre of the latter is narrowed thereby; and the traction caused by hernial descent also changes the line of direction in the bowel, forming a sharp angle at the origin of the diverticulum. Above the narrowed and somewhat obstructed part, dilatation takes place; and a train of unpleasant symptoms result, independently of strangulation—costiveness, colicky pains, dyspepsia, flatulency, etc. The congenital form of diverticulum, on the other hand, may protrude without causing any such inconvenience. Strangulation occurring in either case is marked by the ordinary symptoms, follows the ordinary course, and requires the ordinary treatment. But, probably, the symptoms will partake more sparingly of the signs of obstruction, than in ordinary cases—at least in the first instance.

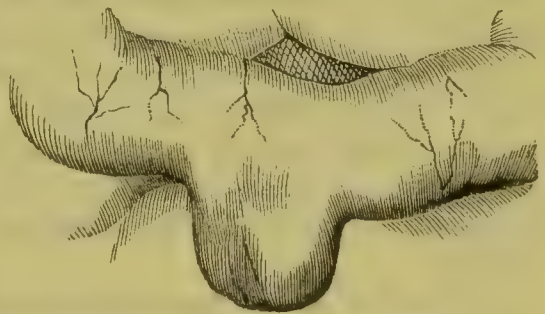


Fig. 317.

Fig. 317. Diverticulum. Its protrusion constitutes the *Hernia Litrica*.

CHAPTER LVI.

AFFECTIONS OF THE RECTUM.

Abscess Exterior to the Rectum.

ABSCESS in the areolar tissue exterior to the rectum is almost always of an acute character, and most frequently affects adolescents, or young adults of a weakly system. There are two distinct varieties, according to the site. One is quite external in the nates, early pointing outwards, attended with no great constitutional disturbance, not tending to burrow backwards on the bowel, and generally getting well under the simplest treatment. The other originates in the ischio-rectal fossa by the side of the bowel, perhaps nearly two inches from the orifice. Pain, in the latter case, is great, and the constitutional disturbance severe; evacuation of the bowels is seriously impeded, and when attempted, suffering is greatly increased; at first no fluctuation is to be perceived, but a hard mass is felt on firm pressure with the finger by the side of the anus, and also when the finger is passed within the bowel; throbbing pain continues, the hardness enlarges, and ultimately a softening may be detected in its centre; matter forms rapidly and in quantity; it may gradually and painfully reach the surface; or, slow in its outward direction, the gut, about an inch from the verge of the anus, may give way by ulceration, and by this internal aperture the pus may be imperfectly discharged.

In treatment, our main object is to procure early and outward escape; our attempts to prevent suppuration, by fomentation and poultices, having previously failed. In the deep variety, the plunge of a bistoury, by the side of the bowel, so soon as softening has begun, is essential to prevent great constitutional disturbance and risk of the establishment of fistula in ano. After evacuation, great attention to the general health will be required; inasmuch as without considerable improvement in the tone of system, it will be found difficult to heal the wound, and equally difficult to prevent recurrence of the abscess. Not unfrequently a cachexy is met with, which baffles all remedial efforts—connected with phthisis of the lungs. In short, idiopathic abscess exterior to the rectum is to be looked upon with suspicion, as regards both part and system, and treated accordingly.

Rectitis.

The inflammatory process not unfrequently affects the rectum; of idiopathic origin; or caused by external injury, lodgment of foreign matter, or exposure to cold; or connected with an excited state of hemor-

rhoids ; or an extension of the inflammatory process from a contiguous part. In acute cases, the symptoms are very severe. The part is somewhat swollen, and most exquisitely painful ; the sphincter and levator ani act spasmodically, and each movement aggravates pain to torture ; intense burning heat is complained of ; a gelatinous discharge like currant jelly passes away, with painful tenesmus, when the patient responds to the frequently repeated calls to stool ; or, in intense cases, the heat is at first dry as well as burning ; the constitution suffers severely by fever. The urinary organs sympathize ; there is painful micturition ; and not unfrequently strangury, or even actual retention, occurs. The progress and results vary. Resolution may take place, with copious mucous discharge—perhaps with hemorrhage. Or the discharge becomes purulent, coming from the mucous coat ; and resolution is both slow and incomplete. Or ulceration may take place ; superficial and broad, limited to the mucous lining ; or circumscribed and perforating, causing an aperture into the areolar tissue without, where fresh abscess forms, and fistula results, or sloughing even may occur. Or, the affection proving of a minor but persistent nature, plastic product takes place in all the coats, but more especially beneath the mucous ; and simple organic stricture is established.

Such being the risks of an advanced or obstinate inflammatory process in the rectum, treatment comes to be regarded as important ; early and effectual, to anticipate evil. In the first instance, the cause is to be ascertained—and, if possible, removed ; foreign bodies, for example, will be taken away, and ascarides expelled. The recumbent posture is enjoined, and blood taken by leeching. No purgatives are given—but gentle enemata, if necessary. To allay spasm, and to soothe the sympathetic irritation under which the urinary organs generally suffer, opium is useful ; in ordinary doses by the mouth ; and largely applied to the part in the form of inunction, enema, or suppository—with or without belladonna. Fomentation can scarcely be applied too hot or too sedulously. In idiopathic cases, accompanied by dysenteric symptoms, ipecacuan, in doses ranging from five grains to a scruple, given at bedtime, and followed by large doses of morphia or Battley's solution, will often act like a charm.

Fistula in Ano.

By this is understood a fistula, or sinus, by the side of the rectum, opening externally on the nates by one or many apertures ; sometimes without any communication with the bowel, and then termed Blind External fistula ; occasionally communicating with the bowel, without an external opening—Blind Internal fistula ; usually having one internal aperture communicating with the external apertures, and then said to be Complete fistula. In the complete form, which is by far the most frequent, there is discharge of purulent matter by the fistulous tract ; flatus also escapes, and the thinner fæculent matters. There is heat and much discomfort, often pain, increased by spasms of the sphincter ; not unfrequently aggravations take place by recurrence of inflammatory attacks ; and usually the general health is more or less undermined. Healing is prevented by at least three circumstances ; the fistulous

condition of the cavity and aperture—obviously unfavourable to contraction and consolidation ; the frequent, almost constant, passage of foreign matters along the track ; and frequent motion caused by the action of the levator and sphincter ani. The sinus may be monocular or multilocular ; that is, consisting of one simple track, or having more than one collateral sinus connected with the main and original one—the minor probably the result of recurring suppurations. The cavity may be wide within ; more frequently it is narrow—of the nature of true fistula ; it may extend high above the sphincter, more frequently its end is within two inches of it. The internal opening—to be found in the great majority of cases—is invariably within easy reach of the finger ; usually about an inch and a half from the orifice ; of various dimensions, sometimes so small as not to admit the end of a common probe, but seldom if ever so large as to allow the passing of a finger's point.

The proximate cause of complete fistula is perforating ulceration from without or from within. Some authorities believe the origin is always from within ; rectitis, or a foreign body, produces perforation ; through the aperture, fæculent matter escapes into the areolar tissue without ; abscess forms there, which, only partially discharged by the internal and original opening, ultimately gains the surface, on the nates, and is thence mainly evacuated. That such is the state of matters in some cases there seems no reason to doubt. But it cannot be denied that the majority follow a different course. Abscess begins in the external areolar tissue of the ischio-rectal fossa, idiopathic, or caused by injury, or following exposure to cold ; it slowly advances outwards, at the same time burrowing by the side of the bowel. The matter may escape externally, while the rectal coats are yet intact, constituting blind external fistula. Much more frequently, there is the internal opening too ; of secondary formation, however, not primary—caused by the pressure from without.

Very frequently, fistula in ano is co-existent with pulmonary phthisis ; probably caused by it, and constituting but one of the symptoms and signs of that intractable malady ; the tendency to ulceration of the intestines so common in phthisis—and so favourable to production of the initiatory perforation occurring in the lower part of the rectum—readily explaining how the anal and pulmonary affections should not unfrequently be in close connection.

The diagnosis of a fistula is not complete, till careful examination has been made, by means of the probe and finger. The latter having been introduced into the bowel, the probe—with a flat spatulate handle, which renders it more obedient to the hand, and enables it to indicate with certainty the direction of the point when curved—is passed gently into the track, or tracks, so as to ascertain their number, position, and extent ; but most especially to ascertain the exact position of the internal aperture—that is, on what aspect of the bowel it has formed ; for, as already stated, it is as to height almost always just within the sphincter. In order to facilitate the entrance and movements of the probe, it is sometimes necessary to dilate the external opening in the first instance. When there is no outward opening, the case being an example of the blind internal variety, there are usually plain enough indications of the site of the abscess—hardness, discoloration, pointing, diminution of the

swelling upon pressure, with the escape of pus from the orifice of the anus ; and a plunge of a lancet or bistoury will at once change the case into the complete form.

The treatment of fistula is simple—and, if the disease be merely local, usually quite effectual. The main obstacles to healing are the fistulous condition of the track, and the frequent motion by muscular action. By laying open the track, and at the same time dividing the sphincter, both are overcome. The patient is made to stoop over a bed, back of a chair, or table, with the limbs unbent and somewhat apart ; if anæsthesia be employed, he is recumbent with the legs raised, or may be laid on his side. An assistant separates the nates to the full. The surgeon, seated, inserts the probe, taking especial care to lodge its extremity in the bowel through the ulcerated internal opening. He then carries the point out at the orifice of the anus, and with a knife divides the septum and releases the probe ; the probe being grooved, so as to admit of a curved, strong, sharp-pointed bistoury being passed along it. Or, the probe having been withdrawn, its place is occupied by the probe-pointed bistoury—used at first merely as a probe ; the point is then met in the bowel by the forefinger of the other hand, and, guided by it, is brought out at the orifice of the anus ; when, with a gentle sawing motion, division is effected of the septum which is contained within the concavity of the instrument. When this is of considerable thickness, or

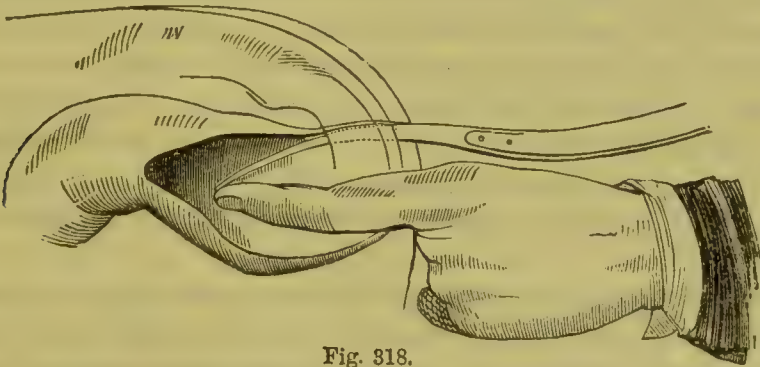


Fig. 318.

of almost cartilaginous density—as not unfrequently is the case—a particularly stout and well-tempered blade must be selected for the service, lest it give way. It is unnecessary, however, to divide any great extent of parts, for the following reasons :—There is almost always an internal opening ; this is invariably situate almost immediately within the sphincter ; it is essential to make the line of division pass through this aperture ; and that having been done, there is in no case any necessity for passing the knife higher, however extensive the fistula may be. It is by no means uncommon to find the track passing higher than the internal opening ; yet in these cases the ordinary operation is all that is necessary ; the knife entering at the ulcerated opening, and no higher. One obvious advantage of this is, the avoidance of danger from loss of blood. A high wound might implicate arterial branches of considerable importance. In the approved operation, only small branches can spring ; they are seen at the time of division, and can readily be secured by

Fig. 318. Plan of the operation for Fistula in ano, the finger and bistoury met in the rectum previously to division.

ligature, if need be—as, however, very seldom is the case. Should any superficial sinus exist—burrowing beneath the integuments—it should be freely opened up at its most dependent point; but there is no occasion for dividing the various superficial ramifications of the sinus throughout all their extent.

In the external form, in progress of formation by abscess originating in the areolar tissue, it has been proposed to evacuate the abscess, and then at once to complete the operation for fistula; hoping thus to save time and pain. It is better to evacuate, and delay; permitting the abscess to contract, and to degenerate into the condition of fistula; then operating for the cure of fistula. The wound is less painful and less extensive; and the result is at least equally satisfactory. Similar caution is advisable in cases of old standing, in which abscess has repeatedly formed around the anus with burrowing; it is well to evacuate and drain by opening and counter-opening, waiting till the suppurated space has contracted, and when much less extensive incision will consequently be required.

In the blind external form—that is, when we have searched carefully for the internal opening, and found none—as will seldom be the case—the probe may be made to penetrate the denuded mucous membrane, and the operation may be completed in the ordinary way; or the probe-pointed bistoury, having been passed to the usual site of opening, has the edge of its blunt point inclined towards the finger introduced within the bowel, where by a gentle scratching with the nail perforation is effected—the bistoury being then carried on and out as usual.

The use of the anal speculum may assist in detecting the internal opening. And when this is found, the speculum may be retained as an auxiliary in the operation; the parts yielding much more readily to the knife when put upon the stretch, as they are by lodgment of the open instrument.

Immediately after withdrawing the knife, bleeding is attended to. If an artery spring, it is tied; if there is oozing, at all formidable, pressure is applied by stuffing the wound moderately with lint. Usually, there is no necessity for any such procedure; and it is enough to interpose a small portion of lint, or other dressing, between the lips of the wound, so as to prevent premature closure of the superficial part; our object plainly being, that the whole track shall heal from the bottom.

Before operation, the bowels should always be well cleared out by a purgative, aided by an enema if necessary. After the operation a full opiate is given; to lull the pain, and at the same time to prevent movement of the bowels—this not being contemplated for a day or two. At the end of the third or fourth day, a dose of castor oil, or other simple and bland aperient, is given; and this, operating, brings away the contents of the rectum, including the dressing of the wound. Afterwards, it is enough to regulate the bowels; to make sure, from time to time, by passing the finger through the wound, that it is not closing prematurely, and that superficial sinuses are not forming; to attend to cleanliness; to apply water-dressing, by means of lint and oiled silk—retaining the dressing by a T bandage, should that seem necessary; afterwards medicating this dressing by ordinary stimulants, as the state of the

granulating surface may require. For obvious reasons, a close regard is paid to the system throughout.

If fistula in ano co-exist with evident and advanced pulmonary phthisis, a question arises as to the propriety of operation. It may safely be answered in the negative. For, first, the operation will fail in its local effect; the wound, in all probability, will not heal. And secondly, supposing that it did heal, the result would probably be most injurious on the system; the pulmonary disease advancing with fresh virulence, on the closing up of an outlet whence purulent and other products had long been habitually discharged. In any case, however, where the existence of the fistula is a source of great pain and irritation to the patient, the operation, as a measure of relief, may be justifiable.

Fissure and Ulcer of the Anus.

Fissures of the anus are extremely troublesome. They are most common in the adult; but no age is exempt; they have even been observed in children at the breast. A chap or crack, analogous to what is observed on the lip, forms within the verge of the anus, in the mucous coat of the bowel; and is the seat of acute lancinating pain, often of intense agony, more especially when the bowels are moved; accompanied with spasm of the sphincter more or less prolonged; and simulating most of the signs of stricture of the bowel. The existence of the fissure may be obscured, in consequence of the obstacle which such spasm affords to ocular examination. In examining the patient, the anal orifice seems almost invisible, from the excessive contraction and retraction of its verge. The nates are at the same time contracted together, requiring to be forcibly separated by an assistant; and when the surgeon attempts to introduce the finger, the suffering occasioned may make the patient leap beyond his reach. In the female, pressure upon the posterior wall of the vagina, within the fourchette, will enable the surgeon to evert the orifice of the bowel, and see the surface of the crack or chap. In the male patient the eversion of the bowel is resisted, and a satisfactory inspection can rarely be effected by causing the patient to strain as if at stool. Sometimes the assistance of a speculum, therefore, may be required. But, in most cases, the sense of touch, and the feelings of the patient, will sufficiently disclose the site and extent of the fissure.

Almost invariably, this affection is found connected with previous disorder of the primæ viæ—perhaps a long continued dyspepsia. And, in treatment, this circumstance has an important bearing. For, no local management can be expected to prove fully successful, unless the cause be taken away; that is, in most cases, the noxious matter lodging in the bowels must be removed, and the functions of the mucous lining must also be amended. In such cases, a cautious dose of calomel will probably be found the most suitable prescription at first; followed up, according to circumstances, by gentle aperients and alteratives. The part may sometimes be benefited by being touched freely with nitrate of silver, or with the fluid nitrate of mercury; but this is quite as painful as division of the base of the sac, and never so efficient. Mere relief of pain and palliation of the affection may also be obtained by

belladonna ointment, or by chloroform made into the form of ointment, or by hot poultices medicated strongly with opium in solution. Very frequently, however, such local treatment is ineffectual; and then a simple and slight operation is required. By means of the fore-finger and a bistoury a vertical incision is made through the mucous coat, including the fissure. And thus the irritable sore is at once converted into a simple wound, which first inflames, and then heals in the usual manner. But should this fail—as will not often be the case—the knife has again to be used; pressing it more deeply, the sphincter ani is divided; and the part, thus set at rest, quickly heals. To recapitulate; in all cases, great and primary care of the stomach and bowels is necessary; with this, some fissures heal under ordinary local treatment suitable to irritable sores; others require simple incision; and others, more obstinate, demand in addition division of the sphincter.

Ulcers of the mucous membrane of the anus are liable to assume the irritable character, and then are productive of the same distressing symptoms as fissure. They require, and are subject to, similar treatment. Situated more internally, they are not ordinarily visible, even on the most careful examination. The finger, cautiously introduced, may detect them, by the peculiar feeling which the ulcerated part conveys to the examiner, and by the great increase to the patient's suffering which is invariably produced by pressure upon the affected part of the bowel. By means of the speculum their exact circumstances may be accurately surveyed. In those cases which evince no great irritability, tannin is often a most serviceable local application, in the form of ointment or suppository.

Immediately in front of the coccyx—that is, at the back part of the anus—a broad and deep ulcer, capable of receiving the finger's point, is not unfrequently observed. For this, exposure by the speculum, and the application of nitric acid, or nitrate of mercury, are usually necessary. It should be borne in mind that chancres sometimes are met with in this situation, not only in females, but also in men. The surgeon should therefore be careful, in dividing the base of an ulcer situated within the verge of the anus, to guard against puncture of his own fingers.

Hemorrhoids.

Hemorrhoids, or *Piles*, are divided into two kinds; *External* and *Internal*; the former situated without, the latter within the sphincter. They seldom occur before puberty, and are perhaps more common in females than in males; certainly more troublesome to the higher than to the lower ranks of life. The predisposing causes are whatever tends to determine blood to the rectum, and to retard the return of blood from it; habitual constipation, pregnancy, abdominal tumours of any kind, torpor of the liver, excitement of the generative organs, sedentary avocations with luxurious living. And the exciting causes are whatever acts irritatingly on the bowel itself, as purging, bilious diarrhoea, exposure to cold and wet, etc.

External hemorrhoids consist either of a congeries of varicose veins, which form tense, rounded, dark blue swellings, covered with mucous mem-

brane and protruding at the verge of the anus—or of the hemorrhoidal veins which are without the external sphincter, surrounded by hypertrophied areolar tissue, and covered partly by mucous membrane, partly by loose rugous integument. They may be undergoing the inflammatory process, or they may be indolent and quiet. At one or more points, ulceration may have exposed their interior, and they bleed; or they may be *blind*, as the phrase is—emitting no blood. The varicose veins may have their normal fluid contents: or these, coagulated, may have caused condensation of the tumour, more or less complete. The tumour may be single; usually more than one exists.

Treatment is either palliative or radical. The latter consists in removing the morbid formation, by scissors or bistoury; leaving the sore which remains to heal in the ordinary way. Palliation varies according to circumstances. If the part be inflaming, the recumbent posture, gentle laxatives, to avoid constipation or straining at stool, and hot bathing and poulticing are necessary. If it be in the indolent state, stimulants and astringents—iodine, galls, tannin, hellebore—are applied, with the view of puckering up the loose integument, obtaining discussion of the solid abnormal textures, and restoring the normal condition of the veins. The bowels should at the same time be carefully regulated; and, for this purpose, sulphur is a favourite medicine—usually combined, in the form of electuary, with pepper confection; and sometimes, too, a proportion of copaiba is a good addition; dosed so as to avoid over-action, while it insures a daily and sufficient passage of a semi-fluid stool. By some, linseed oil taken internally is preferred as a soothing and safe laxative. If any dyspeptic, or other disorder of the *primæ viæ* exist, that must be removed as speedily and thoroughly as possible. Very often the liver is to blame, and requires special treatment.

Not unfrequently, a small, recent, tense pile presents itself, acutely inflamed, and exquisitely painful. A simple proceeding not only affords present relief, but also may effect radical cure. With a lancet or bistoury it is to be laid freely open, throughout its entire extent; the coagulated blood rolls out, a salutary loss of fluid blood takes place, and in subsequent healing of the wound consolidation is effected.

Internal piles are of different kinds.—1. They may be of similar structure with the external; varicose veins, surrounded by hypertrophied areolar tissue, and covered by mucous membrane more or less altered; open, or blind; inflaming, or indolent. 2. They may be genuine tumours, of the fibro-cellular structure; more or less pendulous in their form. 3. They more frequently are spongy vascular growths, with a broad base of attachment, the surface resembling that of the strawberry.

Internal hemorrhoids are most commonly of the last variety. If large and numerous, they may constantly protrude more or less from the anus, or only become external when the patient occupies the erect posture or walks about; gradual dilatation of the sphincter from the pressure of the mass admitting of this. More frequently, they do not show themselves externally, except when the bowels are moved; and then the straining causes them to become unusually turgid, and to descend. If not replaced, they may be constricted by the sphincter, inflame, and become

gangrenous. At each stool, it is common for blood to be lost ; either in a trickling stream, or small arterial jets taking place from one or more points of the surface—more especially if the tumours are constricted. Usually, the patient gets into the habit of replacing the prolapsed tumours after each evacuation ; and, during the intervals, if the growths are small, or there is but one hemorrhoid, he may sustain no great inconvenience in the part. If the loss of blood, however, be habitual—even though but a small quantity escape at each time—the system is certain to give way under it ; the patient becoming thin, weak, pale, and sallow, dyspeptic, annoyed with tinnitus aurium, giddiness, and palpitations. If the tumours are bulky, and often protruded, they are always in a more or less excited state ; there are pain, swelling, heat, and discomfort, discharge of mucous and puriform fluid ; and these, superadded to the effects of loss of blood, speedily undermine the frame. In extreme cases, the whole bowel is relaxed ; and prolapsus ani accompanies and untowardly complicates the hemorrhoidal state. At any time, the inflammatory process may extend from the abnormal structure, and seize the bowel—producing rectitis, probably of an aggravated form. Thence abscess and fistula may result ; or, under a minor degree of disease, simple organic stricture may form. The urinary organs sympathise greatly, during rectal excitement connected with piles—whether these be external or internal.

To allow such an affection to follow its own course, is thus seen to be dangerous to both part and system. Treatment is general and local, palliative and radical. The general treatment is to be pursued in all cases ; regulating the bowels, looking to the liver, attending to regimen ; and hemorrhage may be restrained by the internal exhibition of gallic acid, oil of turpentine, or other suitable astringent. If palliation only be intended, the local treatment will consist of careful reduction, after each evacuation of the bowel, and the occasional injection of some astringent fluid ; such as solutions of rhatany, zinc, sulphate of iron, matico, oak-bark, or tannin ; or the last named remedy may be very conveniently and efficiently applied in the form of suppository. If excitement occur, then come antiphlogistics, anodynes, and attention to the bladder. The radical treatment consists of removal by ligature. In the case of the solid genuine tumour, scissors may be used with impunity. But such formations constitute a small minority of internal piles. The great majority consist of vascular tissue, almost resembling an erectile tumour in its tendency to bleed when wounded. To cut them out, were on each occasion to endanger life by hemorrhage ; not only because the parts are vascular in themselves ; but also because the interior of the rectum is favourable for continued oozing of blood, and ill adapted for the application of pressure or other direct hemostatics. Consequently, deligation is preferred.

The operation by ligature is thus accomplished. The patient having had the bowels freely opened, is placed as for the treatment of fistula. By previous straining at stool—renewed at the time of operation, if necessary—the tumours are made to protrude to the full ; an assistant separating the nates. If the form be at all pendulous, it is well to seize the fundus by means of a large volsella, and over this to apply a strong

ligature, drawn very tightly around the neck of attachment. But if the base be broad, and the form of the swelling irregular, it may be necessary to transfix the base by means of a needle carrying a stout ligature; and, by tying separately the halves of this, so to effect strangulation. The tighter the constriction, the more rapid and less painful is the cure. Deligation having been completed, the ends of the ligature are cut off close to each noose; and, by gentle manipulation, the strangled parts are replaced within the sphincter. If an external hemorrhoid, or loose fold of skin be found, it is removed by the sweep of a knife or scissors; and if an arterial twig of any importance spring, it is at once secured by ligature. A full dose of morphia is given, to lull pain and prevent motion of the bowels. The bladder is watched; and if strangury or threatened retention occur, warm fomentation is to be sedulously applied to the hypogastrium, along with the internal administration of henbane and sweet spirits of nitre, in small and repeated doses. Should the patient, however, not be relieved by these means, the catheter must be passed. By medicated poulticing, and the warm hip-bath, the pain in the anus may be somewhat assuaged. In a day or two, the sphacelated parts separate; and the remaining sore is treated as its circumstances may demand. Foetor is subdued by the chlorides, and by frequent ablution. After cicatrization nightly use of the tannin suppository is sometimes advisable, to promote and insure complete restoration of the normal calibre and tone of the bowel.

In many cases anæsthesia may be used, without detriment to the facility or efficiency of the operation. And a subsequent minor use of chloroform is often of much service in assuaging the after pain.

In the slighter cases, nitric acid has of late been employed with advantage; when the tumours are small, recent, and sessile. The parts having been made to protrude, the strong nitric acid is applied by means of a flat wooden spatula, so as to produce an eschar; and before being replaced within the sphincter, as in the case of deligation, the carbonate of soda must be freely applied so as to prevent diffusion of the escharotic. The eschar separates, removing the altered membrane; the inflammatory change so excited, and the contraction which attends on cicatrization, sometimes suffice after a single application, but more usually repetition is required. By the potassa fusa, too, hemorrhoids may be very efficiently destroyed; the neighbouring parts being carefully protected by the use of vinegar. It should be recollected, however, that the application of the caustic is quite as painful as deligation, while the consequences often prove very much more tedious.

Patients with greatly deranged livers are subject to general fulness in the lining membrane of the rectum, perhaps with one or more internal hemorrhoids, accompanied by a febrile state of system. In such cases, we are not to operate in any way, until the liver has been restored to a healthy or at least quiet state, and the general excitement has been calmed—otherwise the result might be serious, by aggravation of the internal and constitutional disorder.

In elderly, full-living patients, also, affected with disease of the heart, or shewing a tendency to affection of the head, bleeding piles, are not to be rashly interfered with; else the sudden cessation of discharge, and

subsequent plethora, may entail the most calamitous results. The operation, if had recourse to at all, is not performed till after due preparation of the system. And the after treatment is conducted with much care and caution.

Similar precaution is requisite in the case of females, from whom blood escapes in large quantity and periodically, because vicarious. Such rectal bleeding, however, is not always connected with piles. It may proceed from the lining membrane of the bowel, little if at all changed—especially in cases of retroversion of the uterus.

In advanced cases of bleeding piles, it is sometimes difficult to determine whether the *bruit*, palpitation, and other signs of diseased heart are primary or secondary, dependent on an organic cause, or merely on anæmia. Diagnosis, in this respect, requires much caution; and when in doubt, we may lean to the side of operation—ready with leeches, seton, or other compensating treatment, should troublesome consequences threaten.

Polypus of the Rectum.

Simple polypi are occasionally, yet seldom, found in the rectum; most commonly in children; and then they may be mistaken for prolapsus. In the adult, the fundus may become hard, rough, and ulcerated, and prove troublesome by bleeding. There is frequent desire to go to stool, with discharge, uneasiness, and occasionally pain and swelling. At each evacuation, the growth is apt to be protruded, and usually requires replacement. Treatment is removal, by scissors or ligature. Obviously, the preferable method is by deligation; but, after the ligature has been secured on the neck of attachment, the main body, if large, may be safely cut away, in order to prevent the foetid discharge with which so large a slough would certainly be attended. In some cases, they may be dealt with satisfactorily by means of the *ecraseur*.

Prolapsus Ani.

In consequence of relaxation, the rectum may become everted, on straining, and protrude beyond the anus; and the protrusion may be either constant or occasional. Also, it may be either partial or complete; that is, the protrusion may consist of the entire bowel—or rather, as is by some supposed, of the sigmoid flexure of the colon; or it may be merely a descent of the mucous coat alone—a frequent concomitant, as has already been observed, of internal hemorrhoids. This partial prolapsus may occur at any age; and is probably most common in the middle aged; but the complete form is an affection almost peculiar to the two extremes of life; old age and childhood. The child is liable to irritation of the bowel, by ascarides, or by a perverted secretion from the general mucous coat; and the habitual straining, which results, tends to the change in question. In the old man, too, there is much straining; by reason of enlarged prostate, or debility of the muscular coat of the bladder. In the child there is much crying; in the old man much coughing. Stone and stricture may induce prolapsus at any age.

The tumour varies in size, from a mere annular border to the anus—

as in the partial prolapsus—to a swelling as large as a child's head. The membrane, if habitually down and exposed, changes more and more to the cuticular character; much discharge takes place, of a reddish jelly-looking substance; inflammatory aggravations are liable to occur, causing much increase of distress; and, at any time, the existence of descent is accompanied with painful uneasiness in the part, and an oppressive general languor and debility—at least in the adult.

In the child, the affection may generally be removed by riddance of its cause. At the same time care is taken to replace the protrusion after each descent; the bowels are duly regulated, and evacuation should always be effected, if possible, in the recumbent posture; at all events, the child should not be permitted to sit long upon the stool; and efforts at straining should be diminished, by the height of the seat being such as to prevent the feet from touching the floor; crying should be avoided as much as possible; astringents may be used both outwardly and within

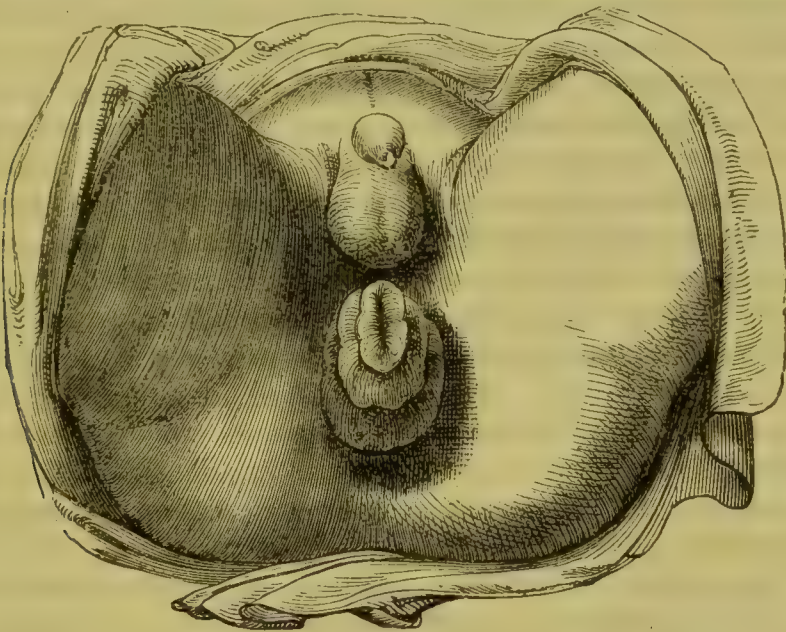


Fig. 319.

—that is, in the form of lotion, ointment, injection, or suppository; and iron or other tonics, with strychnine or nux vomica, are usually indicated, on account of laxity of the general system. If protrusion have been neglected, and have attained a large size and globular form, some difficulty may be experienced in effecting replacement. Pressure is applied, as in the taxis for hernia; the parts having been previously lubricated without. And it is well to make the reducing pressure chiefly during the straining or crying efforts of the patient, the verge of the anus then presenting a fixed point on which the reduction may be made. If the protruded part be found constricted, inflaming, and swoln, it is better not at once to attempt reduction; but, in the first instance, to diminish the bulk and excitement, by leeching, rest, and ordinary antiphlogistic means. In some cases, however, when the venous congestion, and the temperature and colour of the protrusion, indicate that sloughing is threatened, the sphincter should be divided by incision, so as to secure the patient from further delay in the relief of strangulation.

Fig. 319. Prolapsus Ani.

In the adult, there is the same necessity for removal of the cause, if possible ; but cure seldom follows so simply. The same attention to replacement is to be enforced ; and a pad may be worn, directly compressing the anus, so as to oppose reprotrusion. This pad—slightly conical in form, so as to fit into the anus—may be applied by means of the common T bandage ; or, what is better, is adapted to a spring, as in the truss for hernia. Astringents are used, the bowels are regulated ; and amendment, if not cure, is hoped for. It may be well, perhaps, to procure the daily stool at night ; so that afterwards the long recumbency of bed-time may prove favourable, in obviating the tendency to protrusion which is greatest after functional excitement of the part. Often very decided relief is obtained, by wearing a vulcanite plug ; olive-shaped and pedunculated in the part which lodges within the sphincter, and terminating in a short cross handle, sufficiently large to prevent displacement of the instrument when inserted into the bowel.

Such is the palliative treatment. For a radical cure, other measures are required. One or more of the redundant folds of the mucous membrane may be removed, by scissors or ligature ; in the hope that the contraction of healing may sustain the replaced parts in their normal relation. But it is better in most cases, while leaving the bowel intact, to take away the redundant integument externally ; hoping that the subsequently puckered cicatrix may effectually support the parts within, and prevent further protrusion. This removal of skin may be by knife or scissors, or by actual cautery. The latter agent is perhaps unnecessarily severe ; but, whichever is employed, the immediate pain may be safely abrogated by the use of chloroform. These means failing, another operation has been proposed ; an abbreviation of the sphincter. By incision, a portion of this muscle is removed ; and then the remainder, having been brought together, and got to adhere, is expected to constitute a more active and effectual guardian of the mucous outlet. The success of this proceeding, however, has yet to be proved. And, in any such operation, especial care must be taken lest the task be overdone ; and an unnatural tightness of the orifice result.

In the adult, accurate diagnosis is always important. Many a patient, during a long course of years, wears a painful truss for what is supposed to be prolapsus, but is in truth mere looseness of the anal verge, with internal hemorrhoids—remediable, as we have seen, by a very simple operation.

Stricture of the Rectum.

Contractions here, as in other mucous canals, are of three kinds ; spasmodic ; organic and simple ; malignant. The *Spasmodic* does not frequently constitute a disease of itself ; but is rather an accompaniment of some other affection—as hemorrhoids, fissure, or ulcer of the anus. Its main symptoms are, painful tightness of the part, with difficulty and pain in voiding the fæces. The site of constriction is at the orifice of the bowel ; and the immediate cause is spasmodic action of the sphincter muscle. If it be but an attendant of another disease, removal of the latter will ordinarily suffice for cure. In the few cases of its single occurrence, treatment consists in rectifying the primæ viæ, which will

invariably be found more or less deranged ; and in the occasional use of a short bougie, of metal or caoutchouc, passed just within the sphincter, and retained for a few minutes on each occasion. An obstinate case may render division of the sphincter expedient ; and in such circumstances the subcutaneous operation may be preferred. Belladonna may be used, in the form of ointment.

Simple organic stricture may be congenital, and escape detection for many years ; more usually it is the result of a chronic rectitis, as already stated. The constriction depends partly on condensation and thickening of the entire coats of the bowel ; but mainly on organised product in the submucous areolar tissue. The ordinary site is about two inches from the orifice ; and it is seldom indeed that this form of stricture is found beyond reach of the finger. The leading symptom is difficulty in defæcation, with slimy discharge ; the fæces passing in a flattened and attenuated form, like tape, or sometimes like small rounded pellets, when solid ; and when fluid, being liable to forcible ejection as if from a syringe. Derangement of the digestive organs, with impairment of the general health, is induced ; the abdomen becomes swoln, perhaps tympanitic ; and the urinary organs are sympathetically involved. Above the stricture, dilatation takes place, and there ulceration is apt to occur in the mucous membrane ; greatly aggravating the distressing symptoms, and, in the aged, not unlikely to degenerate into malignancy. From the obstructed state of the bowels, enteritic symptoms may perhaps arise ; but, independently of sudden or casual aggravations, life is ultimately endangered by advancing emaciation and general disorder. Treatment consists in maintaining a

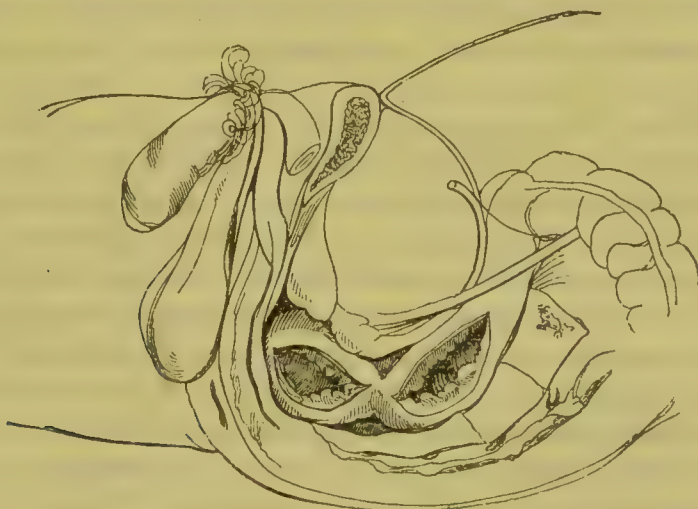


Fig. 320.

gently open state of the bowels, mitigating the painful symptoms in the bowel and neighbourhood by suitable remedies, and gradually obtaining dilatation of the former at the contracted part by a cautious use of bougies ; not failing to remember that the cure is not by mechanical dilatation, nor by inflammatory access, but by gradual absorption of the submucous abnormal product. The best form of this instrument is that made of elastic material, pliable, smooth, yet dense enough to resist circular compression. Having been introduced gently, it is withdrawn at once. The

Fig. 320. Rectum opened laterally ; shewing stricture of the bowel at the ordinary site.

portion of the instrument which is intended to pass is gradually increased in size, until a full size can be used without difficulty. Then dilatation may be deemed complete ; yet, to insure against relapse, a bougie should be passed occasionally for some time afterwards.

Sometimes a tight callous stricture is found to resist the ordinary treatment. Then the knife's edge may be used with advantage ; the surgeon slightly notching the contracted ring at many points, by means of a probe-pointed bistoury introduced on the finger ; and afterwards proceeding with dilatation, in the ordinary way.

Spasm of the anus may simulate organic stricture ; and many of its symptoms also attend on enlargement of the prostate. Consequently, an accurate diagnosis can never be attained without careful examination. By the frequent and forcible dejection of fluids, diarrhoea may be simulated ; and a very erroneous treatment, by astringents, might be enforced, were examination of the part neglected. In most cases, the stricture is within reach of the finger ; and in such, there is no difficulty ; the finger's exploration removing all doubt. Sometimes, however, the contraction is higher in the bowel. And then great caution is necessary in employing the exploratory bougie ; for a fold of mucous membrane, or the natural promontory of the sacrum, in a healthy bowel, may obstruct the point of the instrument for a time, more especially if this be rashly and unskilfully introduced. By disreputable empirics, indeed, such obstruction is made use of as a means of deceiving healthy patients into a belief of the existence of stricture.

Malignant stricture, or *Scirrhus-contracted rectum*, is by no means uncommon in the aged—and more especially in the female ; supervening, usually, on some pre-existing affection of a simple kind ; as piles, or simple stricture. The symptoms are such as attend ordinary contraction, with the addition of severe lancinating pains, a dense, almost cartilaginous induration of the textures, which are nodulated, villous, or ulcerated upon the surface ; while a copious, bloody, foetid, puriform discharge ; greater sympathy of the urinary organs ; greater difficulty and pain in defæcation ; and the ordinary constitutional cachexy which attends and characterizes malignant disease, suffice to indicate the true nature of the affection. When the verge of the anus only is affected, the diseased parts may be removed by the knife. But if the disease extend some way up the bowel, as it usually does, we must content ourselves with palliation ; assisting defæcation by enemata and laxatives ; and lulling pain by opiates, applied to both part and system. Death may take place by exhaustion. But more frequently the patient perishes under symptoms of ileus, the malignant product having advanced so as to cause complete occlusion of the bowel. Under such circumstances, the only hope of postponing death is by the formation of an artificial opening in the abdomen, for fæculent evacuation ; a very doubtful proceeding—as will afterwards be stated.

Medullary tumour sometimes forms between the bladder and rectum ; causing great distress ; interfering first with the functions of the rectum, and then with those of the bladder also. In some cases, even perforation, with the establishment of a communication more or less free between

the bladder and rectum, becomes established. The treatment can only be palliative.

Irritable Rectum.

The lower bowel is liable to become the seat of irritation, unconnected with any structural change ; causing pain, heat, itching, frequent desire to go to stool, spasm of the sphincter, and sympathy of the urinary organs. The source of irritation may be within the bowel itself ; ascarides. Or it may be contiguous ; stricture in the urethra, stone in the bladder, or some affection of the prostate. Or it may be remote, yet continuous as to tissue ; a depraved state of the mucous membrane of the stomach or upper bowels. Treatment is obviously to be begun by removal of the cause, if possible. Afterwards, opium, hydrocyanic acid, chloroform, or other calmatives, may be applied directly to the part, by means of injection, suppository, or inunction.

Itching of the Anus, an obstinate and distressing complaint—an irritation exterior to the bowel—is often the source of intense suffering to the patient. Generally, it is connected with a depraved state of the mucous membrane of the bowel ; and removal of this, by the suitable alteratives—as tar, copaiba, arsenic, etc.—may suffice for cure. Sometimes it attends on piles or fissure, and is removed along with these ailments. Sometimes it is connected with a thickened and chapped state of the skin external to the anus ; and in these cases, as well as in those where no local cause is apparent, applications to the part are essential. Of these the most successful are hydrocyanic acid, tobacco infusion, and camphor powder. The last may be used alone, or in combination with starch, and preceded by the application of a calomel ointment, 3i—3ii to the ounce.

Hemorrhage from the Rectum.

Bleeding from the lower bowel is usually an indication of piles, as has been seen ; of the internal, vascular pile, more especially ; and is almost always arterial. In females, however, it not unfrequently is found independent of prominent alteration in the bowel ; oozing from the lining membrane, merely congested ; and then usually periodic and vicarious. Or it is frequent and exhausting, proceeding from a small vascular eminence on some part of the membrane, discernible only by the use of the speculum. The treatment is obvious ; according to the cause. Hemorrhoids are to be tied. The uterine function is to be restored, and the general frame amended. The vascular point is to be cauterised or deligated, and astringents are at the same time given internally—the best, perhaps, gallic acid. The tannin suppository may be used locally. In some way, the drain must be arrested.

Injuries of the Rectum.

The anus is liable to wound and bruise, as other parts. The former may be formidable by hemorrhage ; the latter by inflammatory change, leading to deep-seated abscess. Treatment is accordingly. A dangerous form of injury used to occur in hospitals, when the old-fashioned metallic

syringe for giving enemata was recklessly used by ill-qualified administrators. The instrument's point, pushed rudely upwards, in a straight direction, is likely to lacerate the bowel. It may perforate ; and then the injection, perhaps stimulant and acrid, finds its way into the areolar tissue, causing extensive abscess, and sloughing, with violent constitutional disturbance. In such cases, the remedy is to make a free and early incision into the infiltrated parts. But the modern enema-syringe, intrusted only to trustworthy hands, is not likely to lead to any such casualty.

Fæces and Foreign Bodies in the Rectum.

In the elderly of both sexes, but especially in the female, with whom irregularity of the bowels is more habitual, the fæces may accumulate within the sphincter, forming a tumour of large size, and occupying not only the whole rectum but also a portion of the sigmoid flexure. The symptoms are most distressing ; painful fulness in the part, bearing down, frequent desire to go to stool, thin and scanty fluid passed, the bladder irritable, sleep disturbed, the stomach disordered, and more or less fever induced. Without examination, the affection may be mistaken for diarrhoea or dysentery ; with an insufficient examination the internal swelling may be supposed to be a malignant tumour. In cases of doubt, the finger's nail will bring away a sufficiency to test the nature of the concretion. In the milder cases, repeated injections of oil, followed by cathartic enemata, may suffice to clear the bowel. In the more confirmed examples, it is necessary to introduce the finger or fingers, with a lithotomy scoop, so as to break down the mass ; afterwards clearing all away by injection. And two or more such operations may be necessary, at different times ; as the higher accumulations may descend only after removal of those which occupied the lower bowel. Afterwards it is obviously of much importance to secure regular and sufficient movement ; with a view to avoid re-accumulation.

Foreign substances may lodge in the lower bowel ; causing inflammatory accession, abscess, and ulceration there, if not removed timeously. They may be pushed upwards from without, by accident, or by malicious design. Or they may be arrested by the sphincter in their progress downwards, having entered by the mouth ; as fish bones, bones of poultry or other small animals, kernels of fruit, etc. Or they may have formed within the alimentary canal ; intestinal concretions. The smaller substances are readily removed by finger and forceps. Large bodies require previous dilatation and lubrication of the bowel ; and an exploratory use of the speculum may be useful. In extreme cases of impaction it may be necessary to divide, not only the sphincter, but even the lower part of the bowel and integuments. In the case of rough or sharp substances, whose forcible extraction in the ordinary way might seriously injure the bowel, a speculum, or pair of large-sized lithotomy forceps, is first carefully introduced past the foreign body, so as to sheathe and protect the mucous membrane.

Imperforate Anus.

Children are occasionally born with the anus closed. There are

three kinds of this malformation. 1. The rectum may be fully developed, and have its orifice shut by a thin membranous expansion only ; or the canal may be obstructed by a membranous septum, at some distance from the orifice—which latter may appear in all respects normal. 2. Or the bowel is imperfect ; ending in a blind *cul-de-sac*, at some distance from the integument of the perineum, in which there is a mere depression or vestige marking where the anus ought to be. In such cases the bowel may open into the vagina in the female, or bladder in the male. 3. Or the rectum is almost or altogether deficient ; the sigmoid flexure of the colon terminating in a *cul-de-sac*, at the upper part of the pelvis. The symptoms present are those of intestinal obstruction, viz., swelling of the abdomen, vomiting, and the absence of all fæcal evacuation. Then peritoneal pain and tympanitic distension set in, and unless the obstruction admits of relief the child speedily sinks.

The first form is easily managed. An incision is made into the occluding membrane through which the dark coloured meconium can be recognised ; and for some days a piece of dressing is interposed, or the finger passed, to prevent union. But often this precaution will be unnecessary ; the daily passage of fæces sufficing to keep the aperture patent.

The second variety is more common, and more troublesome. Some thickness of parts intervenes between the operator and the bowel. And at first the latter may be felt but obscurely, if at all ; there being none of the bulging fluctuation which must soon be apparent in the former case. Under these circumstances, we wait until the meconium accumulates, and till the bowel in consequence descends and is distended. It may then afford some indication of its presence to the finger from without. To assist, let firm pressure be made in the left hypogastric region ; and such pressure should also be maintained, during the operation for relief. The cries of the child are of service. He is placed on the knee of a nurse or assistant, in a position as if for lithotomy. By means of a scalpel, an incision is made in the middle line through the integument in front of the coccyx ; and, by cautious dissection, the bulging *cul-de-sac* is sought for ; the finger always preceding the point of the knife ; the line of exploration following the natural curve of the bowel, in the hollow of the sacrum, lest the bladder, vagina, or peritoneum should be wounded—not keeping too close upon the bone, lest the bowel be overpassed and be mistaken for the bladder—and not diverging to either side, lest the pelvic blood-vessels sustain injury. The *cul-de-sac*, having been reached, is opened freely ; the meconium escapes ; and the wound is to be kept pervious by the careful and patient use of tents—or, what is perhaps better, by the constant wearing, for some time, of a tube such as is used after lithotomy.

After even deep dissection, we may fail to meet the end of the bowel. Then it is quite warrantable to pass a trocar and canula upwards, cautiously, in the direction in which the bowel ought to be ; and on withdrawing the trocar, we may have the satisfaction of seeing meconium follow. Where the rectum opens into the bladder, unless the extremity of the bowel is near the surface and can be easily reached in the manner already described, the case is likely ere long to terminate fatally. Not

so, however, when it opens into the vagina ; such an aperture having sufficed throughout a long life for affording a free passage to the *faeces*. The opening can easily be occluded after the vagina has become sufficiently developed to admit of operative manipulations ; it is more difficult to maintain the patency of the substitute opening made between the coccyx and posterior fourchette.

Of the existence of the third variety we are made aware, when, after waiting for days, not even the slightest indication of bulging or fulness can be detected in the perineum. A perineal wound and exploration may be made ; but with scarcely a hope of success. And, failing in this, we have either to abandon the patient to his fate, or proceed to the establishment of an artificial anus.

The Formation of an Artificial Anus.

The question of artificially establishing an outlet for the contents of the intestinal canal, elsewhere than in the normal site, comes to be entertained, when the rectum is congenitally deficient, and also when it has become in any way insuperably obstructed, by simple stricture, or by carcinomatous and extensive degeneration, by the impaction of an intestinal concretion or of some foreign substance from without, or by the invagination of the lower part of the descending colon through the sigmoid flexure into the rectum. In the case of the child, probably the operation will seldom be deemed expedient ; for when such a grave malformation exists—as entire deficiency of the bowel—others usually accompany it, rendering the viability of the patient under any circumstances very questionable. It were better to leave such to perish, by the original obstruction of the bowels, than to force on them a more miserable and scarcely less brief period of existence. In the case of malignant disease of the rectum, also, practitioners may well hesitate, before having recourse to a difficult and serious operation, for the purpose of attempting but partial and temporary relief, in an affection which must at no distant period end fatally. In such a case, it would seem to be warrantable only under the following circumstances : when the general strength is not yet greatly exhausted by malignant cachexy ; when the obstruction in the bowel is complete, and plainly insuperable by any direct treatment ; when the patient—having had the danger of the operation, and the almost disgusting result of its success, plainly exhibited—himself decides on its performance, and is prepared to abide both the nuisance and the risk. On the other hand, when the rectum is imperviously obstructed by the impaction of foreign matter from within or from without, or by disease not malignant nor necessarily and speedily fatal, and when such obstruction is otherwise insuperable—the expediency of the operation may be safely urged upon the patient.

The lower part of the colon is plainly the part of the intestinal canal to be reached ; and it may be sought either from before or from behind. The former method, first proposed by M. Littre (1720), is of easy performance ; being merely a direct incision upon the bowel through the abdominal parietes and peritoneum, above the left groin. The operation, however, though most simple, is hazardous to life ; and, if successful,

the anus is inconveniently situated, in one respect—the patient being the victim of discomfort to himself as well as the source of annoyance to those around him. The site has its advantages, however, too. The operation is easy, and its steps certain ; the anus, after a time, gets to possess something of a sphinctral power, from the muscular parietes ; and the offensive escape of its contents may be guarded against by wearing a well-fitted truss, the manipulation of which is easily within reach of the patient.

The posterior operation, proposed by Callisen, and greatly improved by Amussat, is performed thus ; its object being to open the colon on its posterior part, where it is uncovered by peritoneum, and which bare space may be expected to be considerable when the bowel is much distended by its contents :—The patient is laid on the side, with the trunk bent somewhat towards the right ; and with a pillow also placed beneath the abdomen, so as to make the left loin prominent. A transverse incision is made, commencing at the outer border of the common mass of the sacro-lumbalis and longissimus dorsi, and extending about four inches in length in the adult, between the last false rib and the crest of the ilium, about two fingers' breadth above the latter ; and if any considerable obesity exist, the posterior part of the wound is crossed by a second incision, parallel to the range of the spinous processes. The different layers of fat, fascia, and muscle, are carefully divided in succession, on the outside of the border of the sacro-lumbalis and longissimus dorsi ; and portions of fat, coming much in the way, may require to be removed altogether. Intestine having been exposed, some doubt may be felt as to its being the colon or not ; the bulging viscus at the bottom of the deep wound may be colon, or small intestine, or kidney. In regard to the last, manipulation and percussion will readily enough characterize intestine. And the great gut may be distinguished from the small, by attention to the following circumstances :—the colon has its muscular fibres of greater development ; the small intestines sustain a motion of alternate ascent and descent—communicated by the diaphragm, and corresponding to expiration and inspiration—while the colon is stationary, being fixed to the loins by areolar tissue ; also, if two portions of bowel present themselves, that may naturally be expected to be the colon which is on the outer aspect, at the external border of the quadratus lumborum. Having become satisfied that the colon is exposed at the bottom of the wound, it is transfixed by a needle and ligature—at two points, above and below—so that it may not slip from its present relation to the wound, after an opening has been made and the contents have begun to escape. The bowel, stretched by the two ligatures drawn outwards, is divided freely between. Air and fluid contents at once pass outwards ; but it may be necessary, by means of the finger, scoop, or forceps, to assist in extrusion of the solid matters. The margins of the opening in the bowel are then secured by suture to the external wound, so that, by adhesion there, a permanent, safe, and efficient aperture may be constituted for faecal escape.

CHAPTER LVII.

CALCULOUS DISEASE.

Urinary Calculi.

HEALTHY urine is a straw-coloured or amber-coloured fluid, retaining all its elements in solution, with the exception of an almost infinitesimal quantity of mucus, which may in most cases be seen to subside after an hour or two from the transparent fluid, forming a very slight cloud at the bottom of the vessel. In various states of disease, on the contrary, the solid matters contained in the urine are apt to be precipitated, either in consequence of simple diminution in the quantity of fluid in proportion to its saline constituents, or from more complicated changes in the constitution of the secretion. Such solid precipitates, especially if composed of saline or crystalline matters, may give rise to distressing symptoms by causing in the urinary passages the formation of *gravel*, and of *stone* or *calculus*; the first term being applied to the finely granular form of deposit, the two last to solid concretions of more considerable size. A stone, once formed, has always a tendency to increase in size by new accretions of foreign matter upon its surface; and in consequence, calculi, when they have acquired sufficient size to be detained within the bladder or kidney, generally give rise to symptoms of increasing severity, and may, sooner or later, require surgical interference for their removal. Hence the study of urinary deposits is important in a surgical point of view; although the constitutional conditions which lead to them fall, for the most part, within the province of the physician, like the other derangements of the urinary secretion. These conditions are commonly called *diatheses*, and may be detected either by the occasional presence of gravelly deposit in the urine, or by such changes in its chemical constitution as are known to give a tendency to precipitation. The existence of any abnormal irritation in the urinary organs, therefore, should in all cases lead to an examination of the urine, and particularly to careful observation of its sediments, if present, with a view to ascertaining, correcting, and thus preventing, any tendency to the formation of calculus.

The means necessary for the examination of urine in relation to surgical disease, are—a good microscope with a magnifying power of at least 200 diameters, a urinometer for testing specific gravity, test-tubes, test-papers, and a few simple chemicals which will be mentioned immediately. By the conjoint employment of the microscope and of chemical analysis, after the manner so fully described of late years by Dr. Golding Bird and others, it is now within the power of every practitioner to detect even the earliest traces of calculous tendency; and no one can be excused for overlooking derangements of the urine, which a few

years ago would inevitably have been allowed to proceed unchecked, until they ended in calculous formation, or at least in the minor evil of gravel.

The normal urinary secretion usually yields, as above mentioned, a slight hazy cloud of mucous sediment, which forms its only precipitate in the state of absolute health. This cloud of mucus presents under the microscope only a very few rounded bodies, resembling closely the cells found in pus, with occasionally traces of epithelium cells from the bladder or some other part of the passages. Often, however, these are absent, or nearly so, and the sediment is altogether impalpable; occasionally, on the other hand, the so-called mucous corpuscles are increased in number, and the mucous cloud which contains them is increased in bulk and opacity. This is the first grade of mucous irritation, and is often found in connection with various kinds of saline deposit. Under a further progress of this condition the urine may become highly impregnated with mucus and epithelium; or the mucous cloud may be supplanted by a distinct deposit of pus.

To the test-paper, healthy urine presents a tolerably distinct acid re-action; this may be feeble, or the urine may even be occasionally neutral, without the presence of any serious derangement; but any degree of persistent alkalinity must be regarded as distinctly abnormal, and requires correction by treatment, unless in the case of its having been induced by medicine or accidental dietetic conditions, which sometimes render the urine temporarily alkaline. According to Dr. Bence Jones, the acidity of the urine undergoes constant changes in amount in healthy persons, according to the condition of digestion; being invariably greatest immediately before meals, and falling to its minimum a few hours after breakfast and dinner; appearing therefore to stand in an inverse relation to the acidity of the stomach. The source of the acid reaction of urine is not known with certainty; it is supposed to be owing not to any free acid, but to the presence of some salt, such as the acid phosphate of soda.

The specific gravity of the urine, and the proportion of solid matter contained in it, are likewise subject to considerable variation at different periods. After a meal and towards the close of digestion, the density of the urine (which has been called in these circumstances *urina chyli*) becomes greatest, and may exceed 1030, as tested by the urinometer. After drinking largely, on the other hand (*urina potus*), it may be reduced almost to the density of water; while the urine passed in the morning (*urina sanguinis*), independently of the influence of food or drink, has usually a specific gravity of from 1015 to 1025. The absolute quantity of urine passed in twenty-four hours varies, as might be expected, with the amount of drink; and has an inverse relation to the specific gravity, which is commonly high in proportion as the urine is scanty. About a quart (forty ounces) of urine may be assumed as an average quantity for an adult.

The principal sediments occurring in the urine, and tending to the formation of calculi, are as follows:—

1st. Deposits of free uric acid, or urates of ammonia, lime, magnesia, and soda (*Lithuria*); 2d. Deposits of oxalate of lime (*Oxaluria*); 3d.

Earthy phosphatic deposits, consisting of phosphoric acid, with lime, magnesia, and ammonia (*Phosphuria*); 4th. Deposits of a peculiar organic crystalline matter, termed cystin (*Cystinuria*); 5th. Deposits of another organic principle, scarcely crystalline, the uric oxide or xanthic oxide of Marcet (*Xanthuria*). Fibrin, carbonate of lime, and silica have also been mentioned as ingredients of calculi; but the deposition of these substances from the urine is extremely rare, and does not appear to have been the result of any peculiar morbid diathesis or tendency, the knowledge of which can be of any important use to the practitioner.

The Lithic or Uric Deposit.—This consists either of the uric acid, or of the urates, tinged with colouring matter; and varies accordingly. 1. The most common is *amorphous*; consisting chiefly of the urate of ammonia; more or less coloured; of a yellow hue, when mixed with the colouring matter of the urine; reddish, like brick-dust, when combined with the purpate of ammonia; and when this latter ingredient is in

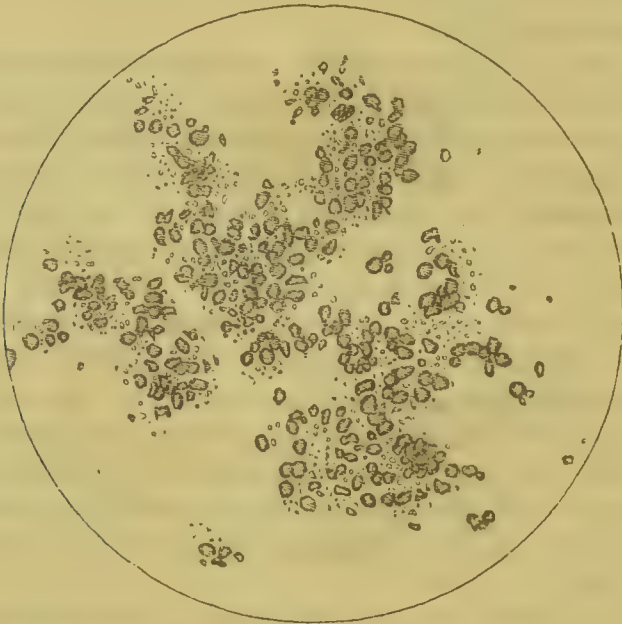


Fig. 321.

much abundance, the sediment is of a pink colour. Such urine is unusually acid, when tested; is of high density; and has a small relative proportion of aqueous matter. When passed, it is clear; but, on cooling, the sediment is deposited more or less abundantly. 2. The *crystalline*; consisting of uric acid, variously tinged by admixture of colouring matter; usually of a reddish hue—the crystals resembling particles of cayenne pepper; and constituting the most ordinary form of gravel, or red sand.

Examined under the microscope the amorphous deposit, or brick-dust sediment, appears either in the form of exceedingly minute molecules, sometimes aggregated together, sometimes dispersed over the field; or in that of larger globular masses, semi-opaque, brownish in colour, and sometimes either grouped together or armed with projecting spicula like stalactites. The last form is unusual, and has been considered by some observers as urate of soda. The crystalline deposit of uric acid assumes

Fig. 321. Urate of ammonia under the microscope.—From DONNE.

generally the form of rhombic prisms, but appears in various modifications of this primary type ; the most usual is that in which the rhomboids or lozenges are very thick and rounded at the angles, so as to resemble, when placed upon their sides, thick cylinders, for which they may readily be mistaken, especially if grouped together in masses, as frequently occurs. The uric acid crystals are generally coloured, and have, under the microscope, a peculiar deep amber tint, which is characteristic.

All the deposits of either free or combined uric acid are highly soluble in caustic potash ; in soda they are less so. The urate of ammonia, which forms the principal part of the amorphous deposit, is tolerably soluble in water at the temperature of the body ; and hence is seldom deposited except on cooling of the urine after excretion. In some cases, however, especially when the urine contains an excess of acid, the urate of ammonia is deposited within the bladder. The uric acid deposit, on the contrary, which is thrown down by the addition of almost any

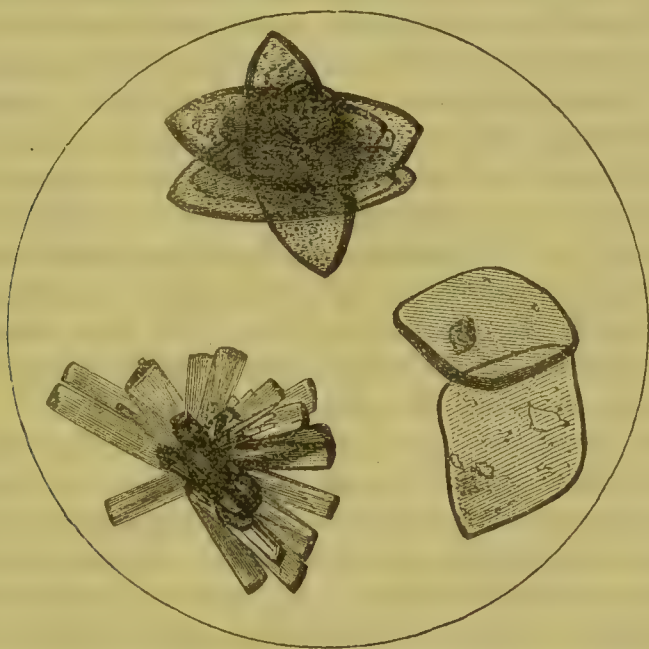


Fig. 322.

acid to urine holding urate of ammonia in solution, is soluble only to a very slight extent in water, even with the aid of heat ; and hence is a comparatively frequent deposit in the urine on emission, although much less common than the amorphous sediment as a result of cooling. Both deposits are decomposed by strong nitric acid with the aid of heat, and leave on evaporation a beautiful lake-coloured residue, which becomes purple in tint by the addition of ammonia (euroerythrin and pink pigment). Urine containing these sediments is usually rather high-coloured, of good or excessive specific gravity, highly acid, and often scanty. Not unfrequently the amorphous deposit is not the result of any derangement of the system, but merely arises from deficiency of drink or from copious perspiration. This is never the case with the uric acid or crystalline sediment.

Uric deposits may attend the slightest derangement of health, or the

most serious ; they denote a sthenic state of system, more frequently than the opposite condition. A trifling disorder of digestion, as by casual error in diet, may cause a tolerably copious sediment ; the progress of hectic, and the decline of inflammatory fever, are accompanied by plentiful deposit of red powder—termed *lateritious*, from its resemblance to brick-dust. The gouty diathesis is marked by uric deposit. Habitual indulgence in much animal food, with deficiency of exercise, and neglect to maintain a clean and efficient state of the skin, will not fail to establish it. It is obviously connected with climate—at least with locality ; the inhabitants of certain places suffering much more than others. It is also connected with age ; prevailing most in childhood, and between the ages of forty and sixty. It is hereditary. It may follow injury of the kidney or its neighbourhood ; congestion being produced in the secreting organ. It would seem to depend proximately, either on an excess of uric acid being generated in the system—by decay of the effete organism, or by mal-digestion of food ; or on the presence of a free acid—the muriatic, acetic, or lactic—which, combining with the base, frees the uric acid, and so leads to its precipitation. Or the causes may be stated in another way, as by Dr. G. Bird : 1. Waste of tissues more rapid than the supply ; as in fever, rheumatism, etc. 2. Supply of nitrogen in the food, greater than is required for the reparation of tissues ; as by excessive indulgence in animal food, and by too little exercise. 3. Digestion insufficient to assimilate an ordinary and normal supply of food ; as in dyspepsia. 4. Obstruction to the cutaneous outlet for nitrogenized excretion ; by skin diseases, or other cause. 5. Congestion of the kidneys ; following injury of the organs, or disease wherein they are affected by sympathy.

Plainly, the treatment must vary according to the cause. In the fevers already mentioned, the deposit ceases as the constitutional symptoms subside. In other cases, the treatment may be said to be twofold. By the exhibition of alkalis, with which the uric acid combines, soluble salts are formed, while at the same time—mainly perhaps by the vehicle in which the alkali is given—the aqueous portion of the urine is increased. And by attention to regimen, exercise, and skin—going more deeply into the matter—we seek to rectify the depraved state of the digestive organs, on which the evil in the great majority of cases primarily depends. Both methods are of service ; but the latter is obviously the more important. They are usually combined. Magnesia, soda, and potass may be given. The first may accumulate in the intestines ; and on this account is seldom prescribed, at least for any length of time. The phosphate of soda is both safe and useful. The carbonate is grateful, and quite efficient. But potass is usually preferred ; its urate being more soluble than that of soda. The bicarbonate is usually given, in half drachm doses ; largely diluted ; and it may be pleasantly combined with a few grains of citric acid. The best period for administration, probably, is about two hours after the principal meals—when alkalis are most wanted to neutralize the free acid of indigestion ; and when at the same time digestion is so far advanced as to render it unlikely that this process shall be interfered with by the alkali. There are also the borate, citrate, and tartrate of potass—all available.

Simple though the alkaline remedies seem, let them never be persevered with carelessly. Their over-sustained use may convert the sthenic state of system into the asthenic, inducing serious constitutional disorder, and causing an ammoniacal and phosphatic state of the urine. The test-paper must be used from time to time, and the state of the system must be carefully attended to.

In those cases in which digestion is obviously weak and imperfect, preparations of iron are useful; the citrate, in solution, may be given in moderate doses after each meal. Regimen is carefully attended to; food being regulated as to both quantity and quality. Nothing at all approaching to a surfeit should ever be indulged in; animal food should be taken sparingly, if at all; vegetables and farinaceous articles may be freely used, provided acidity be not produced; malt liquors should be abstained from; and wine, if taken at all, must be used with great moderation. The bowels require laxatives or alteratives. In most cases, a mercurial purge is a good beginning of the treatment; and, if the sthenic constitutional symptoms amount to a febrile character, cupping may be also practised on the loins. The skin must be attended to; by ablution, warm clothing, friction, and exercise; and if any eruption exist, means must be taken to remedy that. Occasionally, gentle diuretics would seem to be of service. Colchicum, it is well known, is a powerful eliminator of uric acid; and hence, probably, the main reason of its success in gout and rheumatism. When congestion of the kidney is suspected, the treatment is by cupping, rest, and antiphlogistic regimen.

The term "*gravel*" is ordinarily applied to the passing of the uric acid deposit. It begins severely, and is liable to aggravations; and these periods of intensity are termed "*fits of the gravel*"—characterized by pain in the lumbar region, shooting down towards the groin, with pain and retraction of the testicle; frequent micturition, hot and scalding; uneasy sensations in the thighs, very frequently; more or less febrile disturbance; and always plain indications of great derangement of the digestive organs. It is in such cases that purging, antiphlogistic regimen, and sometimes local blood-letting, form so excellent a commencement to the remedial means.

The ordinary treatment may be reduced to the following indications:—1. To diminish the uric formation; by moderate antiphlogistics; regulation of diet and exercise; and attention to the skin. 2. To increase the solvent power of the urine; by diluents, given cold—yet not so as to discourage perspiration; and by gentle diuretics, if necessary. 3. To increase the solubility of the deposit; by preventing or neutralizing the free acid, which, spoliative of the urate's base, causes precipitation of the uric acid; and by presenting an alkali as a soluble base to the uric acid. 4. The fourth indication is one of no slight importance—to favour extrusion of the gravel; by diuretics and diluents; by warm bathing; and by exercise. And, in regard to this, it is well to remember that the particles of uric gravel are especially prone to aggregation.

The Oxalate of Lime Deposit.—The occurrence of oxalate of lime in the urine as a source of calculus has been long known; but the frequency of this deposit was much underrated, until the careful researches

of Dr. Golding Bird, who first investigated the form of its microscopic crystallization, and the symptoms connected with its occurrence in the early stages. It constitutes a species of very minute crystalline gravel, which readily escapes observation by the naked eye, in consequence of the perfect transparency and absence of colour in the crystals. On careful observation, however, they may often be seen as minute glistening points floating in the urine, which usually contains a slight excess of mucus, but is often nearly or absolutely clear.

The crystals are probably precipitated within the organism in most instances; they may, however, be absent from the urine on emission, and be found in great abundance twenty-four hours afterwards. The mode in which they are retained in solution is not known, as the oxalate of lime is exceedingly insoluble in water.

With the exception of a rather high specific gravity, which is usual, there is nothing very characteristic in the appearance of urine containing oxalate of lime. The amount of urea is generally large; often, also, uric acid and its salts are in excess, and sometimes they form deposits which co-exist or alternate with those of the oxalate. The earthy



Fig. 323.

phosphates are likewise usually in excess in oxaluria, but are held in solution in consequence of the acidity of the secretion. The colour of the urine varies from a pale straw-colour to an amber tint, the latter being perhaps more common and characteristic. The urine in this disease generally, as already mentioned, deposits an excess of mucus; and along with this there are sometimes found minute quantities of seminal fluid, as indicated by the presence of spermatozoa under the microscope.

The most usual form of the oxalate of lime as seen under the microscope is that of octohedral crystals, generally not more than $\frac{1}{1500}$ or $\frac{1}{2000}$ of an inch in diameter, and often much less than this; always perfectly transparent, colourless, and exceedingly sharp and well defined

Fig. 323. Oxalate of lime under the microscope.—From DONNE.

in their angles. Occasionally the crystals are "made up of a square prism, with a four-sided pyramid at each end, forming a dodecahedron." Another form much more rare, and possibly not composed simply of oxalate of lime, is that of dumb-bell-shaped or oval crystals, often resembling "two kidneys with their concavities opposed," and possessing a beautiful radiating structure in some cases, while in others they appear homogeneous. The crystals are insoluble in alkalies or in vegetable acids; soluble in muriatic or nitric acid; and on being subjected to a red heat are decomposed, leaving carbonate of lime, which dissolves with effervescence on the addition of acids. In regard to the pathological or physiological origin of oxalate of lime, in the economy, many speculations exist; but none of them are sufficiently precise or well founded to claim attention in a practical work. It is very probable that this deposit has some relation to the decomposition of the tissues, and is formed at the expense of urea or uric acid.

The attendant constitutional symptoms are occasionally slight; commonly, however, they are sufficiently characteristic and distressing to require attention and treatment. The patient is languid, weak, and thin; often remarkably depressed in spirits; usually pale, sometimes of a greenish hue in the face—more especially about the eyes and mouth; pustular formations on the skin are common; and so are scaly eruptions; the slightest exertion induces great fatigue; the temper is irritable; the mind broods over the ailment, and desponds of recovery; dyspepsia is present—troublesome, by flatulence and palpitation, more especially after taking food; aching pain is complained of across the loins; and the sexual power is usually much impaired. Sometimes the symptoms of phthisis are simulated; sometimes those of heart disease. Not unfrequently, water is made with unusual frequency, and with heat and smarting.

The ordinary causes of this affection are, over-exertion of mind or body, excess of venereal indulgence, habitual and gross errors of diet, exposure to cold, injuries done to the lower part of the spine. The oxalic acid would seem to be the product of faulty assimilation; and it readily meets with its base. According to some, the acid may be introduced from without; it being supposed to be one of those substances which are capable of passing unchanged from the stomach to the kidneys. According to this view, the taking of rhubarb, sorrel, tomata, etc., as articles of food, along with the use of hard water as drink, may be deemed very favourable for the establishment of the oxalate of lime deposit.

The treatment resembles that for the phosphatic diathesis. The general functions are looked to; but more especially those of the stomach and skin. Diet is light and nourishing. Malt liquor is forbidden; and a sparing allowance of brandy and water, with meals, is found preferable to wine. Sugar is abstained from. Warm clothing must be worn; and by friction, exercise, and warm bathing, the pores are to be kept free. All sources of exhaustion, and all kinds of depletion are to be avoided. Medicinally, the mineral acids are found of much service; especially the nitro-muriatic, exhibited in some bitter infusion. And of the tonics, zinc and iron are to be preferred; the sulphate of zinc more especially.

Colchicum, too, may be found useful. It is well to remember that, in treatment, the oxalic often changes into the uric diathesis ; indeed it is probable that these two morbid states readily pass into each other—it costing the urea, as it were, but little effort to change into either the uric or the oxalic acids. When, under treatment, the uric deposit is observed to succeed the oxalic, the use of the acids must be abstained from, at least for a time.

The Phosphatic Deposit.—Normal urine contains a considerable proportion of phosphoric acid, the greater part of which is in combination with alkaline bases, and forms salts which are highly soluble. The phosphates of lime and magnesia exist also in small but very variable quantity, and are held in solution, probably by the acid of the urine, along with some of its saline constituents. These earthy phosphates are in greatest quantity after a meal, in healthy persons ; and in various diseases, especially those attended with emaciation, appear to increase in



Fig. 324.

amount. They are precipitated, and form a slight cloudiness in the urine, on the addition of any caustic alkali or alkaline carbonate ; and when healthy urine passes into the state of decomposition, the earthy phosphates are also thrown down, owing to the evolution of carbonate of ammonia from decomposing urea. The precipitate may be either amorphous or crystalline. The former generally consists of phosphate of lime ; the other of the triple phosphate of ammonia and magnesia. This last, in a nearly neutral urine, crystallizes in triangular prisms bevelled at one or both ends, exceedingly transparent and colourless, like the prisms of crystal used in optical experiments. These crystals are very friable, and are consequently often observed irregularly splintered, or shivered into small fragments ; they are always perfectly colourless, and by this character are easily distinguished from uric acid. In a highly alkaline urine (whether spontaneously alkaline or decomposed after emission), the phosphate of ammonia and magnesia occurs under a variety of

Fig. 324. Crystals of the Ammoniaco-magnesian phosphate.—From DONNE.

crystalline forms, corresponding to the basic varieties of the salt. "When rapidly formed, this salt generally appears in the form of six-rayed stars, each ray being serrated, or irregularly crenate, often runcinate, like the leaf of the taraxacum." There are, however, many varieties of star-shaped and foliaceous crystals, consisting of basic triple phosphate; and generally these are mixed with the neutral salt in the ordinary prismatic form above described. All the forms may be readily produced artificially, by adding ammonia or its carbonate in different quantities to the urine.

The phosphatic gravel is usually white or pale grey—whether amorphous or crystalline; it may be precipitated in the form of plain gravel, or it may be either suspended or precipitated in a cloud resembling that of mucus, or it may form as a pellicle on the surface of the urine. The urine is pale and copious; of low density; occasionally alkalescent, when voided; never more than very faintly acid; often turbid, the last portion which is voided presenting a milky appearance—the phosphates being already precipitated; sometimes it emits a heavy, sickening flavour, somewhat similar to that of weak broth; not unfrequently it is ammoniacal from the first, dark-coloured, and loaded with mucus; in all cases, it very soon putrefies, precipitating the deposit copiously, and exhaling a very offensive odour. Very generally, an iridescent pellicle forms on its surface; consisting of minute shining crystals of the ammoniaco-magnesian phosphate.

The symptoms which attend the continuance of phosphatic deposit, are invariably of the asthenic type. The patient is pale, weak, nervous, irritable; incapable of sustained exertion of either body or mind; the bowels are flatulent and irregular; and an oppressive, exhausting pain, or aching, is almost constantly complained of in the loins.

The cause may be local or constitutional. Whatever tends to exhaust the general, and more especially the nervous system, tends to induce this deposit; over-exertion, especially of mind; insufficient food; the habitual use of depressing medicines, as mercury, alkalies, saline purgatives. Also, this deposit is a frequent consequence of injured kidney, and of injury to the spine; and it is an almost invariable attendant on confirmed disease—more especially if organic—in the bladder, kidney, ureter, or prostate. An occasional deposit of phosphates may follow a slight and transient cause; as error in diet, or profuse perspiration under violent exercise. But continuance invariably denotes broken health. The least formidable cases are those in which the ammoniaco-magnesian phosphate alone is found; and the worst are usually those in which the deposit consists of a combination of this salt with the phosphate of lime.

Happily, the phosphatic gravel is not prone to agglomerate within the bladder, unless a nucleus be present; then, however, the cohesion of particles, around this, takes place rapidly.

In treatment—as in that of the uric deposit—we have to direct attention both to the deposit, and to the causes which lead to its formation. The mineral acids—as the muriatic, nitric, or a combination of both—exert a double influence; they increase the solubility of the phosphates, and at the same time give tone to the primæ viæ and general system. They are given in doses of a few drops, much diluted, and gradually increased. Regimen is carefully attended to. Food should be generous,

yet light and moderate ; consisting chiefly of solids. Acescent vegetables, fruits, and drinks, are injurious ; for, however useful the mineral acids, taken from without, may be, acids engendered within invariably betoken derangement of stomach, and that as invariably reacts most untowardly on the urinary organs. Wine may be taken sparingly. Over-exertion in any way is avoided ; free air and laxity of occupation are to be sought ; and the skin's function must be well looked to. The bowels are regulated ; but mercury and saline purges do harm. Diuretics are not given ; neither are alkalies—unless indeed the acids of indigestion plainly are troublesome, and then very small and occasional doses of alkali may be of service. Depletion, in any way, is not to be thought of. Opium is of much service ; by subduing the irritability of system. General tonics are plainly indicated. And the decoctions of the *diosma crenata*, *pareira brava*, and *uva ursi*, would seem to exert a beneficial influence specially on the urinary system.

The Cystine or Cystic Oxide Deposit.—This deposit is rare ; but as



Fig. 325.

it causes one of the most obstinate forms of the calculous diathesis, it is necessary to mention it here. Cystine is always crystalline, though to the naked eye it scarcely appears so, having more resemblance to the paler forms of lithate of ammonia. It forms a yellowish sediment, insoluble by heat, unaffected by vegetable acids, but dissolved by strong mineral acids and alkalies. Ammonia dissolves it very readily, and on evaporation deposits it unchanged in the crystalline form. Under the microscope cystine appears in the form of hexagonal plates, often overlapping each other so as to form rather a confused mass. The ammoniacal solution, slowly evaporated, gives crystals which can usually be distinguished from all others without difficulty.

Urine containing cystine is usually of a more or less deep yellow colour, sometimes inclining to green. Dr. Golding Bird has even seen it grass-green. Its odour is either aromatic like that of sweet briar, or

Fig. 325. Crystals of cystine.

slightly foetid. The quantity of urea and of uric acid has generally been found below the average ; and it is not improbable, from the chemical relations of cystine, that it is formed at the expense of these physiological products. Cystine contains a large proportion of sulphur (26 per cent), and is therefore probably in some way related to the sulphur-extractive which is found in normal urine. Pathology has not yet succeeded in throwing any useful light upon the circumstances under which the cystine diathesis occurs ; the rarity of this deposit proving, fortunately, an obstacle to the extension of our knowledge in that direction. Its occurrence is occasionally hereditary ; and appears to be little subject to any therapeutic control.

The Uric or Xanthic Oxide Deposit.—This is the rarest of all the urinary deposits ; and was first described by Dr. Marcet, as the constituent of a calculus weighing eight grains. Neither its pathological history, nor its chemical properties and relations, have been so clearly ascertained as to demand notice in a practical work. It has chiefly been discovered in children, in the form of calculus. Dr. Douglas Maclagan, some time since, found in the urine of a hysterical female traces of what appeared to be uric oxide ; and his investigations led him to regard the substance found in this case as identical with one of the normal colouring-matters of the urine, precipitated upon a basis of earthy phosphates. It shewed under the microscope granular laminæ, of irregular form, having the chemical characters described as those of cystine.*

Formation and Varieties of Calculi.

The persistent establishment of any of these deposits renders the patient more or less liable to the formation of calculi, and is therefore justly regarded as a calculous diathesis. A nucleus having formed in some part of the urinary passages, the particles of the prevailing deposit are aggregated around it, sometimes in a homogeneous manner, more generally in layers, which may not unfrequently differ widely in composition. The nucleus may come from within or from without. A foreign substance introduced into the bladder, by the urethra, by wound, or by ulceration, and remaining in that viscus, soon becomes coated by calculous matter, even though previously no tendency to such deposit existed. Barley-corns, straws, beans, portions of bougies, or bullets which have gradually worked their way inwards, may thus prove nuclei ; also portions of instruments, lint, or other matters, used in operations on the bladder ; or a portion of necrosed bone may find its way, by ulceration and abscess, into the viscus. By far the most common nucleus, however, is provided by the urinary organs themselves. A few particles of uric acid, or of oxalate of lime—for these, the former more especially, are found to be most prone to formation in the kidney—become coherent immediately after secretion ; and by such aggregation a nucleus is at once formed, soliciting further addition. This addition may be made at the original site of aggregation, the kidney ; more frequently, however, descent takes place into the bladder ; and the small renal concretion then becomes the nucleus of a vesical calculus. Or blood, escaped from

* Monthly Journal, August 1851, p. 131.

the kidney or mucous coat of the bladder, may afford a mass of fibrin, which in like manner may originate the formation ; all the more readily, of course, if a gravelish tendency previously exist. As the stone enlarges, the original nucleus usually retains its central position ; the stone moving loosely in the bladder, and receiving addition equally on all sides. Sometimes, however, the stone is found to occupy a steady position, even when not encysted ; lying undisturbed behind an enlarged prostate, having one side in constant and immediate contact with the mucous membrane, and presenting only a part of its periphery to the source of additional deposit. In such cases, the nucleus will be found occupying a lateral position in the stone's section ; enlargement having taken place almost exclusively on that aspect which looked into the free interior of the viscus.

Stones vary in their nature according to the diathesis which prevails during their formation. The following are the varieties :—

I. *The Uric or Lithic Acid Calculus* ; consisting chiefly of uric acid, but often containing a greater or less proportion of urate of ammonia. This is by far the most common class ; comprising probably about two-thirds of all calculi. The colour is brownish yellow, sometimes like that of pale mahogany ; the surface is either quite smooth, or finely tuberculated by crystals ; a section shews aggregation of the particles in a laminated concentric arrangement ; the form is generally oval, and at the same time flattened ; and the size may vary from that of a pea to that of a large plum. The tests are—solubility in caustic potass ; gradual consumption before the blow-pipe ; digestion in nitric acid, and gentle evaporation, producing a scarlet residue, which becomes purple on the addition of ammonia.

II. *Urate of Ammonia Calculus*.—This salt, as just stated, enters more or less into the construction of the uric calculi. Sometimes, but



Fig. 326.



Fig. 327.

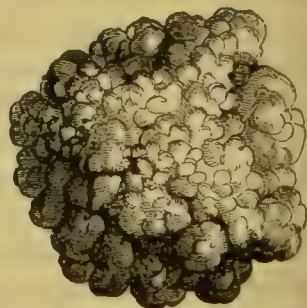


Fig. 328.

rarely, it forms a concretion by itself. The surface is similar to that of the uric ; more frequently tuberculated than smooth ; it is of a clay colour ; the fracture is fine and earthy ; and the layers are concentric. This comparatively rare calculus is peculiar to children. The tests are

Fig. 326. The triple phosphate surrounding a mulberry concretion.

Fig. 327. Nucleus surrounded by oxalate of lime ; and this covered by concentric layers of urate of ammonia. From a child.

Fig. 328. Oxalate of lime, or mulberry calculus.

as for the preceding ; with this addition, that ammonia is evolved during solution in potass.

III. *The Oxalate of Lime, or Mulberry Calculus* ; not unlike a mulberry in size, form, and colour, rarely larger than a walnut ; by no means unfrequent, especially in young people ; always of slow formation. The colour is dark brown ; density and weight are comparatively great ; the surface is almost always rudely tuberculated, or covered with prominent excrescences ; the texture is imperfectly laminated ; and the stone is always single. The tests are—solution in nitric acid, when reduced to a powder and heated ; the blow-pipe, consuming the acid with efflorescence, leaves quick-lime in powder, which, if moistened, gives to turmeric paper a red stain.

Small calculi of oxalate of lime, in size, form, and general appearance, very like hemp-seeds, sometimes form in the kidney. Descending, they may be extruded with the urine ; but if one remain in the bladder, it becomes variously coated, according to the diathesis that prevails. If the oxalic diathesis continue, the hemp-seed sooner or later passes into the mulberry formation.

IV. *Phosphate of Lime Calculus*.—Calculi seldom consist of this salt alone. When they do, the surface is smooth like that of porcelain ; the colour is a pale brown ; the texture is regularly but loosely laminated ; the form is spheroidal. The stone is friable, and usually of small size. The tests are—solubility in nitric and muriatic acids, and precipitation by liquor ammoniæ ; resistance to the blow-pipe, unless at a very intense heat. This formation commonly enough occurs in alternating layers with other deposits.

V. *The Ammoniaco-Magnesian Phosphate Calculus* ; commonly called the Triple Phosphate Calculus—although that term might with fully as much accuracy be applied to the next variety. This and the following seldom occur as composing stones entirely ; but rather as coatings or layers of others—the uric and oxalate of lime more especially. The colour is nearly white ; the surface is covered with minute shining crystals ; the texture is not laminated, or at least is imperfectly laminated ; the stone is soft, easily broken and pulverised, and may attain to a large size. The tests are—solubility in acetic or muriatic acid ; evolution of ammonia, when treated with liquor potassæ ; diminution and imperfect fusion under the blow-pipe, exhaling an ammoniacal odour.

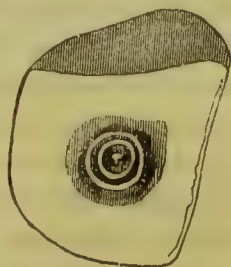


Fig. 329.

VI. *The Fusible Calculus* ; composed of the ammoniaco-magnesian phosphate, conjoined with phosphate of lime ; is white and friable, like chalk ; and may stain the finger when touched ; the size and form are very various ; frequently it attains to a very large size, and is often met with encrusting foreign bodies. The test is, its remarkable fusibility into a clear glass before the blow-pipe. It is partially soluble in dilute-acetic and sulphuric acids, the remainder dissolving in muriatic acid, and insoluble in caustic potash, but when treated with it giving off ammonia.

VII. *The Carbonate of Lime Calculus* is common in the lower ani-

Fig. 329. The triple phosphate surrounding a centre of uric acid.

mals, but rare in man. It is white, spherical, smooth, and very friable ; and dissolves in muriatic acid, with effervescence.

VIII. *The Cystic Oxide Calculus* is also rare ;* of a yellowish-white colour, semi-transparent, glistening, wax-like aspect ; the surface smooth, but of a crystallized appearance ; not laminated in texture, but presenting the appearance of a confusedly crystallized mass ; the fracture exhibits a peculiar shining lustre ; small fragments are semi-transparent. The blow-pipe elicits a peculiar odour, like that of sulphuret of carbon ; and there is a ready solubility in alkalies and mineral acids.

IX. *The Uric or Xanthic Oxide Calculus* is still more rare than either of the preceding. The texture is compact, hard, and laminated ; the surface is smooth, the shape ovoid, the colour cinnamon-brown. The tests are—consumption before the blow-pipe, leaving a white ash, and exhaling a peculiar foetid odour ; solubility in acids and alkalies—more readily in the latter ; the residue of solution in nitric acid, evaporated to dryness, of a bright lemon-yellow colour—whence the name.

X. *The Lithate of Soda* sometimes enters into the composition of calculi ; but very rarely constitutes a calculus of itself. The mass is white, friable, and soft, like what is seen in the tophous concretions of gout, in the neighbourhood of joints. The tests are—solubility in caustic potash, with the aid of heat ; in treatment with dilute sulphuric or muriatic acids, the soda is separated, while the uric acid remains and may be obtained by filtration and washing.

XI. *The Fibrinous Calculus*, like the xanthic oxide, occurs with extreme rarity. And, perhaps, the term calculus is scarcely applicable to the almost solitary case on record ; in which small concretions were passed, of the size of peas, yellow, like wax, and composed of fibrin—probably the result of a bloody clot, in either the kidney or bladder. Such formations, however, as already stated, may not unfrequently constitute nuclei of the ordinary calculi.

XII. *The Alternating Calculus*, though last in the arrangement, is not the least frequent in occurrence. Few large calculi, indeed, fail to present more or less of the alternating character ; the nucleus consisting of uric acid or oxalate of lime ; variously coated or alternated ; the last covering invariably phosphatic, and most frequently of the nature of fusible calculus. The mulberry or uric calculus, having formed, creates much irritation in the urinary organs, and causes changes also in the general system for the worse ; the urinary secretion becomes more and more depraved ; and at last that derangement is produced which is favourable to the formation of the ammoniaco-magnesian phosphate ; this is deposited on the growing stone, and, uniting with phosphate of lime now furnished by the diseased mucous membrane of the bladder, constitutes the fusible formation.

Such are the varieties of Urinary Calculi. Those ordinarily occurring are, the uric, mulberry, phosphatic, and alternating. Forming in the kidney, and remaining there, a calculus is said to be Renal ; originating in the bladder, or growing there after descent from the kidney, it is said

* I had occasion to remove a calculus of this nature, successfully, from a patient on whom Mr. Liston had removed a like stone fifteen years before.—Monthly Journal, 1849, pp. 791 and 886.

to be Vesical ; originating in the urethra, or arrested there in its passage outwards from the bladder, it is said to be Urethral ; formed in the prostatic ducts, it is said to be Prostatic.

Stone is most common in temperate climates, and in early years ; of adults, the old are more frequently attacked than the young. The sedentary are more liable than the active, the luxurious than the temperate, the males than the females. Certain districts are remarkably prolific in stone : Norfolk, for example, and the east coast of Scotland. The disease is doubtless hereditary, like its kindred affection, gout ; and this circumstance may obviously be made somewhat subservient to the explanation of prevalence in certain localities. Frequency of occurrence leads to skilful practitioners and the flocking of patients ; the patients recover, and raise a breed of men of like tendencies with themselves. Where the disease is rare, on the other hand, the treatment is less skilful ; the affected migrate, and the chance of reproduction from those who remain is but slight.



Fig. 330.

Injuries of the spine obviously favour alkaline formations ; causing perversion of function in the kidney, and in the lining membrane of the bladder, with want of expulsion or self-cleansing power in the latter viscus. An injury done to the kidney itself also favours stone ; by disordering secretion, and at the same time furnishing coagula as nuclei for the formation. Long-continued strictures, and affection of the prostate, are obviously predisposing causes ; deteriorating the secretion of urine—through disorder of the general health, and prolongation of irritation from the original seat of disease, upwards to the kidney ; at the same time opposing satisfactory expulsion of the bladder's contents. Some children seem born with stone ; afflicted with congenital calculous diathesis.

The treatment of calculous disease plainly resolves itself into the following indications :—1. To prevent the formation of stone, by correction of the calculous diathesis. 2. To favour spontaneous expulsion of the stone, when formed. 3. To diminish suffering, and delay progress of the disease. 4. To remove the stone by operation, when circumstances are favourable. 5. Unfortunately we are not yet warranted in filling up as a fifth indication, removal of the stone by lithontriptics, or other means independent of operative interference.

Renal Calculi.

Renal Calculi at first consist either of uric acid, or of oxalate of lime ; most frequently the former. Particles cohere, either simply to each other, or round a nucleus of blood-clot, fibrin, or other animal substance. And a beginning having been made, however slight, addition speedily takes place, provided the calculous diathesis continue—as is not unlikely, seeing

Fig. 330. Section of an alternating calculus ; chiefly composed of uric acid.

that the irritation of the calculus reacts unfavourably on the kidney, causing continuance or even increase of depraved secretion. Mere sand may remain in the tubuli ; but calculi lodge in the infundibula ; and thence may descend to the pelvis of the kidney. And if a calculus continue in any of these cavities for some time, a peculiarity of shape is acquired—diagnostic of such formations—dependent on the form of the cavity ; in fact, the stone—though usually small, oval, and smooth, of a reddish-brown colour and granular surface, like uric calculi in general—sometimes enlarges to a considerable size, forming an accurate cast of the pelvis and infundibula, or assuming the form and appearance of a piece of rough branching coral. This happens when the calculus continues to be renal ; more frequently, however, it descends by the ureter to the bladder ; thence to be expelled by the urethra, or to enlarge into a vesical calculus. If it remain in the kidney, serious changes take place in that organ. The cavity or cavities are completely occupied ; then, the size increasing, encroachment by pressure is made on the texture of the gland, until this may come to consist of little more than a mere cyst, within which the large stone is contained. Sometimes active inflammatory change occurs ; the kidney suppurates ; the matter, obeying the general rule of seeking the external surface, may point posteriorly ; and, evacuation having taken place, the stone may be felt by the probe or finger.

The symptoms of stone in the kidney are generally as follows :—A dull aching, with a sensation of weight, is felt in the loins ; with a sharp pricking feeling in the region of the kidney. Sometimes there is pain in the scrobiculus cordis ; sometimes there are fits of vomiting ; generally the stomach is irritable. The urine, from time to time, shews an admixture of blood ; and, along with this, the discharge of small fibrinous clots is apt to occur, especially after exercise ; which, when rude and violent, aggravates all the symptoms. There is frequent desire to make water, with pain referred to the orifice of the urethra, and to the testicle upon the affected side, which is sometimes tender upon pressure and retracted. Numbness, pain, and cramp in the corresponding thigh are very common. Febrile aggravations are liable to occur, the kidney becoming the subject of intercurrent seizures of an inflammatory nature. Purulent matter may descend from the pelvis, and be voided with the urine ; and by continuance of such discharge, by the hæmaturia, by the pain and general disorder, serious exhaustion may ensue. Generally, irritation descends ; and the bladder ultimately sympathises more or less, by functional or organic disorder. Large calculi, occupying the whole gland, may sometimes be felt by external manipulation ; and, in the open suppurated condition, a very accurate diagnosis may be arrived at, as already stated.

Generally the stone, at no long period after its first formation, descends by the ureter ; this movement being induced by its own weight, and by the flow of urine. Sometimes, however, it is arrested in the passage ; an event towards which the irregular and oval form of the calculus is manifestly favourable. The ureter may be, in consequence, either wholly or partially obstructed. Usually the form of the calculus is such as to favour the urine's escape by its side ; but still even such partial obstruction, if long continued, may lead to very serious results ; dilatation of the ureter above, of the kidney's pelvis, and of the infundibula ; absorption

of the proper structure of the kidney ; and consequent interruption to the function of that important organ. Indeed, under such circumstances, the parts have been found reduced to the condition of a chronic abscess ; the distended pelvis and infundibula being converted into a flocculent surface secreting much puriform fluid. And other dangers attend on the arrest ; inflammatory disease, kindled in the obstructed part, may extend to the parts adjoining, and may involve the abdomen in peritonitis ; or ulceration may take place, with perforation ; and through the aperture fatal urinary extravasation may occur ; or the calculus may find its way into the intestine. It has even been known to become arrested at the point where the ureter crosses the bifurcation of the common iliac artery, and setting up ulceration in the urinary channel and the adjacent artery, to cause a fatal hemorrhage into the ureter and bladder. Complete obstruction by the arrest is fraught with utmost peril ; distension of the pelvis and infundibula, rapid and great, is likely to cause suppression of urine—always most hazardous ; there is a greater risk of suppuration and ulceration than in the partial case ; and the over-distended ureter may even give way by bursting. In the case of partial obstruction there is a chance—though a remote one—of ulceration proving chronic and sthenic ; preceded and accompanied by plastic formation, and consequent consolidation of tissues ; advancing towards the surface ; and ultimately discharging the offending body externally. Or the calculus may remain in the ureter with partial obstruction ; as it enlarges, it usually assumes the form of an hour-glass, the increase of deposit taking place chiefly at either extremity ; and sooner or later death is the result. Occasionally, a descending stone has been known to become arrested in the termination of the ureter ; one part within the ureter, partially obstructing it ; the other projecting into the cavity of the bladder, and receiving increase there ; constituting a troublesome variety of vesical calculus.

A small smooth calculus may glide down the ureter imperceptibly. More frequently, descent is marked by symptoms. The patient is sick and vomits ; he is alarmed, feeling a change, and afraid of the result ; he is attacked by cold chills and shivering ; the pain shifts from the kidney, shoots downwards in the course of the ureter, and often down the middle of the corresponding hypogastric region and thigh—intense, and sometimes almost insupportable ; the testicle is retracted and painful—the seat of neuralgia, or irritation ; sometimes the irritation induces the inflammatory process, and acute orchitis results. The pulse is comparatively little affected, but fever may at any time supervene, in consequence of inflammatory seizure in the ureter, kidney, bladder, or testicle. If arrest and obstruction take place, all the symptoms are much aggravated. In most instances the urinary secretion, by dilating the ureter, favours the onward progress of the calculus, and washes it into the bladder. When, however, the obstruction is complete, and the other kidney insufficient, from old-standing disease of its secreting texture, to maintain a sufficient excretion of the elements of the urine, uræmia with somnolence and fatal coma is almost certain to ensue.

The treatment of renal calculus consists in favouring descent, and palliating the urgency of the symptoms. The warm bath relaxes ; opium does the same, and assuages pain ; purgatives and diuretics favour descent.

Smart exercise is also of service. In the first instance, antiphlogistics are not demanded; they are held in readiness for the threatening of inflammatory accession. Not the least important part of the treatment is the adoption and maintenance of such means as are best suited for overcoming the diathesis on which the existence of the stone depends. Should there be reason to apprehend arrest in the ureter, with complete or even great obstruction, diuretics and diluents will of course be refrained from; but laxatives, such as castor-oil combined with opium, or cannabis Indica, will afford relief. When, however, the vomiting precludes us from such a mode of administration, either opiate enemata may be given, or chloroform administered by inhalation, and its effects maintained so long as the attack lasts. The warm bath, and even venesection, may sometimes be found advantageous. When the descent of the calculus has been completed, and the bladder is reached, diluents will be found useful in favouring complete expulsion of the foreign body.

When a large stone lodges in the kidney, and its presence can be made out with tolerable certainty, nephrotomy has been proposed; cutting into the gland from behind, and extracting the stone. This is not warrantable, however, except in those cases in which nature has effected the greater part of the procedure; when suppuration has taken place; when the textures intervening between the stone and the surface are matted together and consolidated; when the stone has become superficial; and when, in short, there is no risk of any mistake in diagnosis, or of inflicting a fatal injury. Then the pointing abscess may be opened, or the aperture already existing may be enlarged, and the stone may be seized and removed. Such cases, however, are very rare, as can readily be understood.

Vesical Calculus.

As already stated, vesical calculus may originate in the bladder, formed on a nucleus there. More frequently, it may be said to be a continuation of the renal concretion. On descent having been completed, the sufferings which accompanied it generally cease; the patient enjoys a period of comfort; and he is apt to imagine himself rid of the malady. Uneasiness, however, returns; and in no long time the symptoms of stone in the bladder become marked and characteristic. The water is passed with unusual frequency, and with more or less pain. Desire to evacuate the bladder is not only frequent but sudden and irresistible; and the evacuation does not bring relief. On the contrary, the pain, which existed during micturition, is aggravated when the bladder is empty, and when spasmodic contraction of the middle coat expels the last few drops of urine, and brings the morbidly-sensitive mucous membrane into direct and rough contact with the calculus. The pain is referred chiefly to the point of the penis, with a sensation as if something lodged there; and, in consequence, the prepuce and end of the glans are liable to be pinched and pulled by the patient involuntarily. This especially takes place in children; and in them it is common to observe the forefinger and thumb pale and sodden in their points like those of a washerwoman. We may find elongation and cedema of the prepuce, from the same cause. A slight change of posture may induce the desire for micturition. It is

sure to be induced and aggravated, as well as the pain, by exercise ; more especially, by being roughly jolted in a cart or other carriage ; and then, too, we may expect the urine which is passed to be more or less bloody. A stooping posture is usually adopted during micturition ; sometimes the patient rests on his knees and elbows ; sometimes he leans over and rests on his head ; or has positively been known to stand upon his head, his feet resting against the wall ; the object being to avert pain, by removing the calculus from the most sensitive part of the bladder—the trigone. The water at first may flow in full stream, and then it may stop suddenly ; the stone having moved to the posterior orifice of the urethra, and temporarily occluded it, causing aggravation of pain. By change of posture, the stone is dislodged, and the flow restored. The stone, acting constantly as a source of irritation to the lining membrane of the bladder, induces congestion there ; increase and change in the secretion result ; mucus coming in greater quantity, and more viscid than usual. And hence a common symptom of stone is, the presence of such mucus in the urine ; settling down in the bottom of the pot, and often shewing itself there in great quantity, on the water being carefully poured off. If a chronic inflammatory process have been lit up in the inner coat, the mucus degenerates still farther, and resembles purulent matter. If suppuration have occurred, the membrane at the same time ulcerating, the bladder will contain more or less of true pus. And under such circumstances, the urine will generally be found dark-coloured, turbid, alkaline, and foetid. The rectum sympathizes, more especially in children ; the bowel becomes irritable ; or hemorrhoids form ; or prolapsus ani occurs. Frequently there is a sympathetic uneasiness elsewhere ; the testicles may be tender and retracted, from time to time ; pain often shoots down the thighs ; and unpleasant heat is sometimes complained of in the soles of the feet.

The symptoms are not uniformly severe, but are liable to remissions and exacerbations ; the latter, termed “fits of the stone,” are attended with great agony—as the self-performed operations of the blacksmith of Amsterdam and the cooper of Königsberg abundantly testify—goaded on by torture to the desperate effort of ridding themselves from the stone by their own hands. These aggravations are induced by exercise, error in diet, or constitutional disorder ; and the greater part of the suffering, it is probable, is directly dependent on spasm of the muscular coat of the bladder. The symptoms also vary according to peculiarity of constitution. One patient may suffer intensely, enjoying scarcely a moment’s ease ; while another complains but little, and follows his usual avocations, little disturbed ; and yet the local circumstances may be very similar in both. And again, a variety in suffering is found to depend very much on the nature of the stone and the diathesis. The mulberry, contrary to what would be expected, occasions less uneasiness than the smooth uric concretion. The phosphatic stone probably occasions more suffering than any other form of calculus ; the general system being more deranged, as well as the mucous membrane of the bladder being in a diseased state ; and both being consequently prone to resent the stone’s stimulus ; in other words, both the general and the local sensibility are morbidly increased. Also, with a varying diathesis, the intensity of the

symptoms will vary. The oxalate of lime at first gives little trouble ; but it becomes coated with uric concretion, and increase of pain at once announces the change ; again the oxaluria prevails, and a remission in the symptoms is experienced. But should the phosphatic diathesis ensue, the symptoms are more severe than they have yet been. For not only is the aggravation of the symptoms local ; the constitution also suffers, and that seriously.

By supervention of enlargement of the prostate, the symptoms may be either mitigated or increased. If the gland simply increase in bulk, the former result may take place ; the swelling coming to occupy the most sensitive part of the bladder, and consequently saving that from contact with the stone. But if the gland be ulcerated towards the bladder, and the stone rest in contact with the ulcerated surface, suffering will be greatly aggravated.

The most ordinary and diagnostic signs of stone are—frequent, sudden, irresistible, unrelieved desire to make water ; pain at the point of the penis, best marked after the bladder is empty ; mucous urine, occasionally bloody ; sudden arrest of the flow of urine, and restoration of the flow by change of posture. These fully warrant the surgeon in suspecting the existence of vesical calculus, and in adopting the necessary means to detect it ; but of themselves, they never prove the existence of stone. The general symptoms of stone—and even the most pointed of them—may be very closely simulated by other affections ; by organic disease of the kidney, by renal calculus, by irritation or organic disease in the rectum, by disease of the coats of the bladder, by prostatic affection, by stricture of the urethra. Certainty can never be arrived at without the use of the sound.

This operation consists in the introduction of an instrument into the bladder, by means of which the stone may be felt and heard, when the instrument comes in contact with its surface. The operation must always be regarded as an important one, requiring care and skill in its satisfactory employment. As the introduction of a sound by the urethra, and its movement in the bladder during perquisition, must always be attended with more or less uneasiness or even suffering—unless anæsthesia by chloroform be employed—and as there may always be a greater or less risk of undue excitement following, it should not be at once and indiscriminately resorted to. It can readily be understood how the careless and rude use of a sound in an irritable bladder and patient—had recourse to after walking, or travelling in any way, and not protected by rest and suitable treatment afterwards—may induce serious cystitis, with implication of the kidney ; and it is salutary to remember that a cystitis thus caused has once and again proved fatal. A patient—say from the country and just arrived—presenting himself with the ordinary symptoms of stone, is not at once to be sounded, and at once dismissed. We should first ascertain that pulse, kidney, and bladder are sufficiently quiet to admit of this operation being practised with impunity ; and, after its performance, rest should certainly be enjoined for some time, perhaps with sedative, or even antiphlogistic treatment. In children, and in irritable adults, it is well to use chloroform, as formerly stated.

The instrument best suited for the purpose of sounding, and in com-

mon use, is of steel, of medium size, furnished with a broad and smooth steel handle, and straight till within two inches of the extremity—where it is sharply curved. Of steel, and broad in the handle, so that its impingement on the calculus may be the more distinctly felt; and of a sharp, short curve at its end, so that the straight portion being in the urethra, while the whole of the curve is within the bladder, the end may be moved about in that viscus freely, and in all directions; of medium size—not so large as to be grasped tightly by the urethra, and so be limited in its movements—and yet large enough to afford a steady grasp to the operator, with surface enough for readily striking the stone. The bladder should be as much distended by retained urine as the patient can conveniently bear; so as to afford room for the instrument's play. The patient is placed recumbent; and, the sound having been gently introduced, the convexity of its curve is pressed in the direction of the ordinary site of stone—at the most dependent part of the bladder, behind the prostate. There, a hard substance being felt, the instrument is moved sharply, with a gentle striking movement; and, in addition to the rub which was at first conveyed to the operator's hand, a distinct *click* will be heard, while a more defined and vivid impression of impingement on a foreign body will be felt. And without this combined indication of touch and hearing, the surgeon should never be satisfied of the existence of stone. If nothing be found in the ordinary site, the instrument's point must then be moved carefully and inquiringly in every direction; groping at first, as a probe; and, on finding resistance, moved with a sharp yet gentle stroke. Of four sources of fallacy we must be constantly on our guard; the rub of the end of the sound on fasciculi of the bladder;* the grating of it on calculous matter entangled in the mucous lining; the rub of a rough and enlarged prostate; and the rub and grating of calculous matter in the prostatic or membranous portions of the urethra. If nothing is found in the ordinary site and in the ordinary way, posture is changed, and the search renewed; first in the erect posture, and then with the patient stooping much forward. The space above the pubes, in the latter position, is particularly explored. The stethoscope may possibly be of service, applied over the region of the bladder; but it is difficult to repress the thought, that wherever a stone actually is, the signs emitted by the sound's use will be sufficiently distinct without the aid of mediate auscultation. Change of posture having failed to detect stone, change in the state of the bladder may next

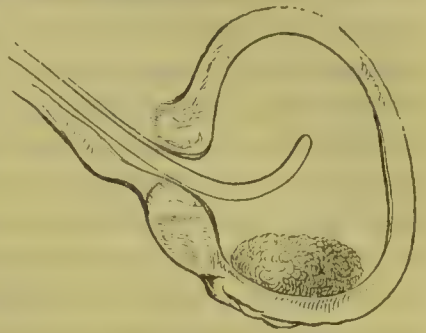


Fig. 331.

* In using the catheter for retention of urine in the aged, a fasciculated portion of the thickened bladder sometimes comes suddenly in contact with the end of the instrument, interrupting the urine's flow, and giving the sensation of stroke or rub to the operator's hand. This, to the unwary, may simulate the presence of stone; and has to be guarded against accordingly.—*Vide* Adams on Diseases of the Prostate, pp. 76, 77.

be tried. The urine may be allowed to dribble away by the side of the sound ; and, as the bladder contracts, the sound is moved gently in various directions, so as to favour distinctness in the sensation of contact should the stone descend upon it. Or a catheter, shaped like the sound, may be substituted ; and, during rapid contraction of the bladder, contact may be ascertained. After failure by all the ordinary means, success has followed the use of an elastic catheter in this way :—With the bladder full, the patient, erect, makes water in a full stream through the instrument ; and, as the last drops escape, the stone falls on the point of the catheter and is felt. In all cases of difficulty, the introduction of the fingers into the rectum to support the prostate and elevate the trigone should be employed, especially in children and elderly patients. In the former, the calculus will usually be found to fall backwards towards the fundus, and then come in contact with the sound ; in the latter, the finger seems rather to act by raising the surface of a medium-sized stone above the level of the enlarged prostate, thus bringing it within range of the instrument. In some of these last-mentioned cases, by turning the beak of the sound round, and sweeping it behind the prostate, a small calculus will be felt which has previously escaped detection. In some cases, a sound curved like a lithotomy staff forms a better instrument for discovering a stone than the short-beaked one.

Whenever difficulty is experienced in detecting a stone, in a case of plain symptoms, it is better to repeat gentle exploration at intervals, than by one continuous and prolonged perquisition to endanger the occurrence of cystitis and sympathy of the kidney—perhaps peritonitis by extension, and death. In children, the prudent surgeon is not satisfied with any obscurity ; the click and rub must both be very distinct ; the restlessness and crying of the patient being otherwise apt to lead to deception. It is chiefly in such cases that blank lithotomy has been performed. And to guard against this, it is in such cases that the use of chloroform is especially serviceable.

But, by the sound's use, we may ascertain some of the characters of the stone, as well as its existence. Moving the point over the stone's surface, we may be able to estimate the smoothness or roughness of it. Passing it over, and on all sides of the stone, we may obtain some idea of its form and bulk ; and, by the finger of the other hand in the rectum, we may in children be greatly assisted in this conclusion, by feeling its weight, as it were, while at the same time its diameter, at least in one direction, is made apparent. Moving the sound in the bladder, we may have a distinct sensation of one stone being left, while another is encountered by the instrument ; or plurality of stones may be indicated by another circumstance, the stroke of the instrument eliciting different sounds at different parts of the bladder—the sounds differing as to clearness, and as to pitch or tone. Also a large stone is at once detected ; a small one may long elude the sound. And again, while the rub and grating imparted by a large stone are most distinct, the click of a small stone is more clear and defined ; and the following practical inference may be almost arrived at—the smaller the stone the sharper and more distinct the click ; the larger the stone the more palpable the feel. Further, when the symptoms have been of long duration, we may expect

a large stone ; and *vice versa*. Also, phosphatic formations are apt to be larger than those of any other kind.

The continued irritation, by the stone's presence, induces serious change in the coats of the bladder. The mucous membrane, as already seen, becomes congested, and sustains perversion of its secretion ; the mucus is at first viscid and clear, afterwards discoloured and phosphatic. By a chronic inflammatory process the membrane may be thickened ; under the acute process it may ulcerate, discharging pus copiously. The muscular coat, under frequent stimulus to contract, and frequent obedience to that stimulus by violent and spasmodic contraction, becomes hypertrophied ; and after death, the fasciculi are seen coursing in their interlacements, salient and strong, with depressions between. The cavity of the viscus is contracted ; and such diminution in capacity is usually proportioned to the increase of bulk in the muscular fibre. Between the fasciculi, the depressions get deeper and deeper ; and frequently the mucous coat becomes protruded outwards, so as to form pouches or sacs, of greater or less size ; within which in rare cases a calculus may become embayed, or a fresh concretion may form. Abscess may occur between the coats ; usually discharging itself into the viscus ; sometimes opening outwards, by perforation, into the cavity of the peritoneum, or into the deep areolar tissue of the pelvis—either event most hazardous—or into the rectum. And thus, in three ways, a cavity may be produced for the encystment of calculus ; by internal opening of a parietal abscess ; by hernial protrusion of the mucous coat, outwards, through the muscular ; by deepening and enlargement of a depression between the hypertrophied fasciculi. The inflammatory process may invade the whole coats ; chronic or acute. Gangrene has sometimes occurred ; ulceration and abscess are not unfrequent. In the aged, chronic cystitis is almost inevitable ; then the phosphatic mucus, which attends this affection, increases the growth of the stone ; and phosphatic deposit, becoming entangled in the viscid mucus which adheres to the lining membrane, may lay the foundation of other concretions, or constitute a broad adherent layer of calculous matter. The prostate sooner or later becomes enlarged, in those advanced in years. The kidneys suffer more and more by derangement of function ; ultimately organic disease is not improbably produced. And under such advancement in disease and suffering, it need not surprise us that the issue of the malady is death. At the same time it is not to be forgotten, that many a patient, with large stone, bulky prostate, and diseased bladder, lives for years, and may die of an ailment with which the stone is unconnected.

The effects of time on the stone itself are important. The most obvious is enlargement ; slow, in the case of the mulberry ; in the uric, seldom rapid ; in the phosphatic, rapid and untoward. And be it remembered, that whatever the nature of the original concretion be, its ultimate coatings will be phosphatic, if it remain long ; its irritation never failing to induce the phosphatic depravity of secretion, in the kidney and in the mucous coat of the bladder. By sacculation of the bladder's walls, an opportunity is afforded for encystment. And if this take place, the symptoms are all mitigated—may indeed wholly disappear. But the stone slowly receives addition within the pouch ; and

probably will come to project through the aperture of communication. On such projecting portion, deposit takes place with greater rapidity ; and then we may expect the symptoms of stone to be revived more or less intensely. Occasionally, the stone undergoes spontaneous disruption ; sometimes after unusual violence of exercise, sometimes in connection with no assignable cause. In such cases, the stone is usually phosphatic ; the particles being more loosely aggregated than in the uric or mulberry concretions. The event is generally to be regarded as untoward, when the stone is of any considerable size. A stone of considerable size, spontaneously disintegrated, may be expelled by the urethra, without much suffering, and with no danger ; but in most cases, unless speedy relief be afforded by our art, the issue is almost certainly fatal. The sharp irregular fragments inflict great injury on the urinary organs ; some may obstruct the urethra, causing retention of urine, with its various calamitous results ; the rest excite cystitis, acute

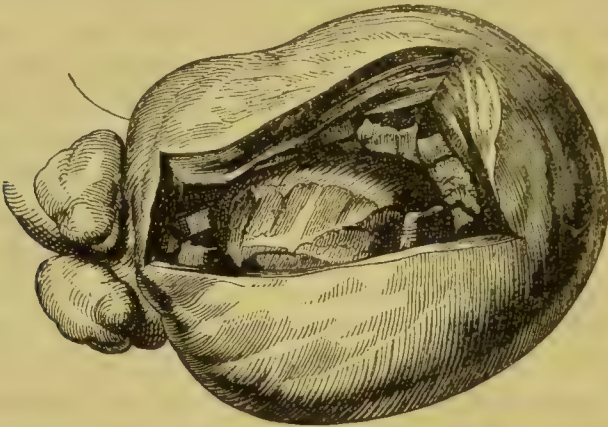


Fig. 332.

and intense ; the bladder becomes filled with coagulated blood, and from this cause a formidable retention of urine may result ; the kidneys sympathize ; and, under a complication of disorders, the system is apt to be overborne. Lately a case occurred under my observation, in which the immediate perils of retention by coagula in the bladder were got over, as also the first brunt of the cystitis ; but at the end of the third week, the patient perished by abdominal peritonitis, found to result from extravasation of urine through perforating ulcer of the bladder.

In a few very rare cases, ulceration of the coats of the bladder has had the happy effect of permitting spontaneous extrusion of the stone ; through the abdominal parietes in the hypogastric region ; through the perinæum into the rectum ; or into the vagina. But such a result, so rare, hazardous, and improbable, manifestly cannot be taken into account in consideration of ordinary treatment.

Treatment of Stone in the Bladder.

No treatment can be adopted with propriety, until an absolute assurance has been obtained of the existence of stone.

Fig. 332. Bladder containing a calculus in fragments. Spontaneously disrupted. Termination fatal ; by inflammatory results.—LISON. *Elements*, p. 633.

Having, by sounding, ascertained the existence of Vesical Calculus, the treatment of it naturally resolves itself into the following indications:—

I. *Assist Nature's effort to expel the offending body.*—This, obviously, is applicable only to calculi of small size; those, for example, which have recently descended from the kidney. Their natural progress is outward, with the current of urine. And in females this is usually effected readily; the urethra being short, straight, capacious, with its current impetuous; and hence one reason why vesical calculus in the female is rare. In males, however, there are many obstacles. The urethra is both long and tortuous, it is comparatively narrow besides, and its current is proportionally defective in expulsive force; spasm, too, is liable to interfere. And yet, judiciously assisting Nature, small stones may be thus got rid of; by dilatation of the urethra, diluents, and forcible voidance of the urine. By the occasional introduction of bougies the urethra is brought to more than the normal dimensions, while its irritability is also diminished;* and by the use of diluents the flow of bland urine is considerably increased. It is well, also, to accustom the bladder to considerable distension by its contents. Then, with the bladder full, and the urethra occupied by a full-sized bougie, the patient stands stooping; and, the bougie having been suddenly withdrawn, evacuation is made in as full and forcible a stream as possible. In the case of enlarged prostate, the main obstacle to the escape of a small stone by the urethra is at the lower or posterior part of the outlet; it is well, therefore, under such circumstances, that the patient expel his urine in the prone position.

The only objection to this mode of treatment, is the risk of arrest in the urethra, inducing retention of urine with its many dangers.

II. *Attempt Disintegration medicinally.*—Attempts at expulsion having failed, or being deemed inadvisable, the following other modes of removal may be thought of; solution within the bladder, forcible abduction by the urethra, disintegration by mechanical means, excision. The first of these indications may be attempted in two ways; by medicines given by the mouth; and by injections into the bladder. Of the former class of remedies, the alkalies are the most prominent; especially the carbonates of soda and potass, given in small doses very copiously diluted—imitations of the natural waters of Vichy, of repute in calculous disorders. The oxalate of lime calculus resists their influence. But the uric formations may be benefited in two ways; alkalies thus given tend to correct the diathesis whereby the calculus has arisen, and at the same time have undoubtedly a sedative and corrective effect on the urinary organs—improving the secretion of the kidneys, and assuaging the irritability and disorder of the mucous coat of the bladder. They arrest the growth, and palliate the symptoms of stone; and experience would seem to say, that a slow and uncertain diminution of the stone occurs during their sustained use. Farther, the voice of experience certainly conveys the fact, that their continued use—provided it be in small doses, greatly diluted—has no injurious consequences either on the renal secretion or on the general health.

* It has been proposed to introduce belladonna into the rectum, so that the neck of the bladder may be relaxed and dilated—like the iris.

In the case of phosphatic formations, large doses of alkalies must prove prejudicial ; but doses such as already mentioned fail to do harm, and at the same time seem to have the effect of favouring gradual disintegration of the stone, by solution of the animal matter whereby the calculous particles cohere.

Further experience in the use of these simple lithontriptics is much to be desired. But it is to be feared that the long-continued use which is essential, and the uncertainty of the issue, will prevent any general employment of, or confidence in them. No doubt, however, they are of much value in a subsidiary place ; as means of delaying the increase of uric formations ; favouring disintegration of phosphatic calculi—as a prelude to Lithotripsy, for example ; in all cases of stone, improving the state of the urine and of the lining membrane of the bladder, and so mitigating the distressing train of symptoms.*

Solvent injections into the bladder have been in use since 1792 ; with various degrees of expectation. As yet, unfortunately, their success is far from great ; and we can only place them in the same subsidiary rank as internal lithontriptics. The agents employed have naturally been alkalies and acids ; the one in uric formations, the other in phosphatic ; introduced by means of a syringe operating on a double canula, whereby a constant stream may be kept in play on the calculus within the bladder. The objections are the same as before ; delay in treatment, and uncertainty in effect. The acid injections, however, may be not without their efficacy, as palliatives of the symptoms attendant on phosphatic calculus ; employed weak, as correctives ; not strong, as solvents. Of late, the carbonate of lithia has been considered a promising solvent for uric concretions ; and the salts of lead have been proposed, as suitable for injection in the case of the phosphatic.

III. A method of *Snaring* has sometimes proved successful, in the case of small calculi. It having been observed that, in removing catheters used on account of retention, small calculi were occasionally found entangled in their eyelets, or lodged in the tube—it was thought that in cases of calculus, this, when small, might be so ensnared and withdrawn. M. Bourguenod was the first to adopt the practice ; and he met with a few imitators. But success depends evidently too much on chance, and that chance is too remote to admit of the procedure being favourably entertained by the practical surgeon.

IV. *Forcible Evulsion* may be attempted, by the urethra. By the forceps of Cooper, for example, a small stone may be seized and withdrawn. But all such proceedings have been justly superseded by Lithotripsy. The perquisition was painful and tedious ; in seizing the stone, the lining membrane of the bladder was liable to receive injury ; and, after seizure, it was not improbable that the attempt at extraction might prove abortive—the stone perhaps becoming impacted in the urethra, and locked at the same time most inconveniently in the jaws of the instrument.

V. *The Calculus may be Disintegrated by Instruments.*—In fulfilment

* At all times, however, even the most cautiously sustained use of alkalies must be watched, lest serious injury accrue to the system by its over-saturation with them.—*Vide* Lancet, No. 1177, p. 318.

of this indication there are two methods—Lithotrity, and Lithotripsy; the latter the more modern, and preferable.

Lithotrity signifies a boring or rubbing of the calculus, in the hope of its becoming pulverized. This was first put in practice—at all events in modern times*—in 1800, by General Martin; who operated on himself, with partial success, by means of a file. In 1813, Gruithuisen proposed the use of a canula, through which, by means of a wire, the calculus was to be noosed, and then attacked by a borer. In 1819, Elderton invented a more feasible instrument. But neither of these were used in practice. In the same year, Dr. Arnott did good service, in illustrating the capabilities of the urethra and bladder, for the reception and play of suitable apparatus. In 1822, Amussat, Leroy, and Heurteloup busied themselves in this department; the latter most ingeniously. And in 1823, M. Civiale, availing himself of the labours of his predecessors, invented a three-branched boring apparatus; well adapted for drilling stones when caught—equally apt, however, to seize the coats of the bladder, and not very well adapted for disposing of the stone effectually. Its success in practice proved but indifferent. And, now, all such implements have been superseded by the crushing apparatus—more simple, safe, and effectual—whose use constitutes Lithotripsy.

Lithotripsy.

To remove calculus by crushing is a more modern idea than that of boring or drilling. Various instruments have been proposed and used; some with screws, some with hammers. At present the voice of the profession apparently prefers the former; on the principle of the instrument originally invented by Mr. Weiss in 1824; composed of two blades, abruptly curved at the extremity—the one sliding on the other, and propelled by means of a screw.

A stone having resisted all endeavours towards its spontaneous expulsion by the urethra—and after, perhaps, a vain attempt has been made towards disintegration by medicinal means—has but two ways of being efficiently dealt with—Lithotripsy, and Excision. Some years ago, a hot controversy was waged between the supporters of these operations; each party maintaining their adopted procedure to be the best, and applicable to all cases of stone in the bladder; one party attempting to grind or crush every stone that presented itself, the other using the knife indiscriminately. Fortunately, a better state of things now exists. The well-educated surgeon, finding himself equally well qualified to perform either operation, is in a position to consider, calmly and impartially, the bearings of each case that comes under his care. Some he finds suitable for Lithotripsy, others not; and so some stones he attempts to crush, and others he at once sets aside for excision. And therein he does well. The one operation does not, and cannot, wholly supersede the other; and yet there is every reason to believe that often the crushing operation is by much to be preferred; not less formidable in all cases of stone; but certainly less formidable in those whose circumstances we recognise

* ALBUCAZIS and SANCTORIUS had notions of bruising stones, and invented instruments for the purpose.

as adapted to its use. The indiscriminate employment of the operation, however, has been fully established as somewhat more fatal than the indiscriminate performance of Lithotomy.

The cases favourable to Lithotripsy are of the following character :— The urethra must be free from stricture ; the prostate must not be large ; the bladder must be comparatively free from irritability, not much diminished in capacity, and not sacculated ; the kidneys must be organically sound. Otherwise, the instruments will not have room for safe and efficient play ; the risk of cystitis will be great ; aggravation of renal disease will be certain ; and fragments, being received into sacculi, will be placed temporarily beyond the reach of treatment, and will enlarge into fresh calculi. The stone itself must be of no great size, and of no great toughness. The mulberry calculus is usually dense and firm enough to resist all the pressure which may be exerted safely ; stones of large size—say of uric formation—are obviously not amenable to the grasp of the instrument ; and, even if they were, the number of rough fragments, and the many seizures which would be required for their pulverization, would obviously tend to serious mischief in the bladder. Further, it were well that no great amount of viscid mucus were secreted from the bladder ; for this, entangling part of the *debris*, is likely to retain more than one nucleus for the reproduction of stone. Such are the cases favourable for Lithotripsy ; when the urethra and kidneys are organically sound, and the bladder and prostate are but little altered ; the stone small and soft ; the system not irritable. At one time it was supposed that the operation should be limited to adults ; the parts of the child being too limited for free and safe use of the instruments. Experience has proved, however, that such objection does not hold good ; and that with suitable instruments, carefully and skilfully used, Lithotripsy is quite as applicable to the adolescent as to the adult.

Even in the favourable cases, Lithotripsy is not without its risks and disadvantages. In the hands of the most expert, the stone is not always readily and at once caught ; and perquisition may consequently be tedious and hurtful. The fragments must irritate the bladder more or less ; entailing at least some of the hazard which attends on spontaneous disruption. Fragments passing by the urethra create much irritation there, and may induce serious inflammatory disease, extending to the bladder ; or a fragment may be arrested in its outward passage, and cause perilous retention of urine. Small portions may remain behind, eluding the sound, and becoming sure nuclei for reproduction—loose in the bladder, entangled in adherent mucus, embraced by a fold of membrane, or embayed in a sacculated cavity. One operation is seldom sufficient ; repetition is necessary, perhaps once and again ; and, under this, serious constitutional disorder may arise, prominently connected with renal disease. It has been well remarked by Dr. Willis, that even the successful cases may present the following degenerate class of symptoms. Although the stone is gone, “the man is not quite well ; irritability of bladder to a greater or less degree remains behind ; this irritability increases ; the constant services of the medical attendant again become necessary. The patient is next tormented with ceaseless pain in the region of the bladder, which by and by extends up the loins, and settles in the back. The

urine has never been healthy in its character, or it has altered at an early period of these untoward symptoms; by and by it becomes like turbid whey; it has a faint, sickly smell; it coagulates on the addition of nitric acid and when exposed to heat; the patient loses flesh and strength; his stomach fails him; he becomes sick and vomits; he begins to dose; and then he falls into a state of coma from which he never awakes; or he is seized with convulsions in which he expires."*

Such, then, we hold to be the true position of lithotripsy; applicable to certain cases of stone; for these less hazardous than lithotomy, and therefore to be preferred; always, however, liable to the objections of long time—comparatively—consumed in treatment, risk by repetition of the operation, and the danger of exciting or aggravating renal disease.

When a favourable case presents itself, the operation is not at once performed; a certain period of preparation is essential. The general functions must be placed in a healthy state; tongue clean, pulse natural, bowels open, skin acting well, etc.; all phlogistic tendency must be overcome, by a certain amount of antiphlogistic regimen; the urethra—if need be—must be dilated, and deprived of morbid irritability, by the occasional use of a bougie; the bladder, too, must be accustomed to tolerable distension. A weak solution of the bicarbonate of potass or soda may also be given; with the double view of amending the secretion of urine, and assuaging both renal and vesical irritability—especially the latter—at the same time favouring disintegration, by loosening cohesion of the calculous particles.

Circumstances being deemed favourable, the patient is placed recumbent, on a convenient table, bed, or couch; with the pelvis elevated on

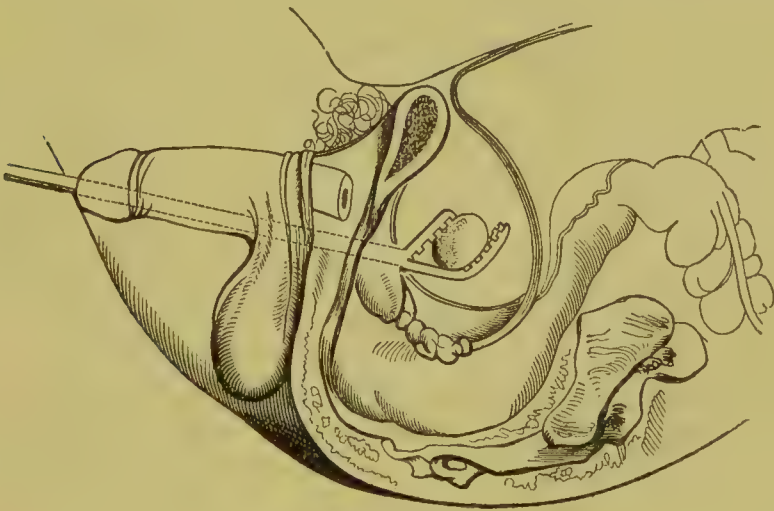


Fig. 333.

a cushion, so as to throw the stone into the fundus of the bladder, away from the neck; and with the bladder as full of urine as possible, in order to admit of seizure, retention, and crushing of the stone taking

* WILLIS on Stone, p. 108.

Fig. 333. Plan of lithotripsy. The stone caught, and the instrument in a suitable position for crushing.

place within the cavity, at a safe distance from the coats. And if there be any doubt as to the quantity of urine retained for this purpose, let a pint of tepid water be slowly injected by means of a syringe and catheter. Then the fenestrated lithonriptor, to prevent inconvenient impaction of fragments, having been introduced, is used first as a sound; and the stone is usually struck where it is to be expected, at the then most dependent part of the viscus; the convexity of the instrument is made to press on the mucous coat of the bladder at this point, while at the same time the thumb of the right hand moves the sliding blade backwards; then a slight wriggling movement is made with the wrist; and the stone, tumbling into the depression made by the downward pressure of the instrument, is felt between its jaws and secured. Others prefer laying the curved point of the instrument alongside the calculus; they then carefully open the blades, and turning the handle a quarter of a circle, move the blades together to feel if the calculus is within their grasp. Where, again, the operation is performed in a case where the stone lies behind the prostate, the beak of the instrument may require to be revolved half a circle to secure the stone between the blades. Having got hold of it by any of these modes, the direction of the lithonriptor is then changed, so as to bring the stone into the supposed centre of the viscus; away from the mucous coats, and with urine all around. Then the screw is applied, and the work of crushing proceeded with. But if there be any doubt as to the instrument being free of the lining membrane, it must, in the first instance, be moved from side to side, or turned round, so as to make sure of this essential point. A small friable stone may be pulverized at one sitting. Usually, fragments are made; which in their turn require separate seizure and crushing. And for this latter work, a solid lithonriptor is preferable, as there is now less chance of clogging such an instrument; and, being imperforate, it is more efficient in dealing with small fragments, which might in a great measure elude the force of the instrument first used. Enough having been done—and to estimate this, we must consider not only the amount of crushing, but also the patient's tolerance of the proceedings—a full-sized catheter is introduced, shaped like the lithonriptor; on opening its jaws, urine, with the finer of the detritus, freely escapes; and this extrusion—harmless and painless, because passing through the metallic instrument—may be favoured by once and again injecting the bladder with tepid water, by means of a syringe fitted to the catheter; but only provided the feelings of the patient admit of this. He is then put to bed; absolute rest is enjoined; opiates are freely administered, by both mouth and rectum, if need be; diluents are given; and antiphlogistic regimen is enjoined. Should excitement threaten, opiates, local loss of blood, and hip-baths may be required. During some days, fragments and sand continue to pass, with more or less suffering; and, by and by, again the urine becomes clear and free. The bladder and system recover from their disorder; a tolerance of the operation is again established; and repetition may consequently be resorted to, with all due caution. When, after one or more sittings, we have reason to suppose that the stone has been completely crushed and passed, careful perquisition is to be made with the ordinary sound, used

carefully, while urine is escaping from the patient recumbent ; repeating this search after injection of the bladder with tepid water. Should such manipulation fail to detect any lurking fragment, the patient may be relieved from treatment ; much care being expedient for some considerable time, however, lest either renal or vesical disorder—especially the former—ensue.

It is a question whether chloroform should be used or not in this operation ; the objection being that the patient's feelings are useful to determine whether or not injury to the bladder's coats is avoided, and that in deep stupor the urine is apt to dribble away involuntarily, perhaps emptying the bladder ere the operation is well begun. The former evil—the more serious—may be escaped by care and skill in handling the instruments, the latter by pressure of the fingers, or the use of a jugum penis. The advantages of anæsthesia are evident ; especially in relaxing all spasm, as well as voluntary effort, which might impede manipulation.

Lithotomy.

This operation is very suitable to children. It is preferable to lithotripsy in adults when the stone is large, and when it consists of the oxalate of lime ; when the prostate is enlarged, and also when the bladder is intolerant of perquisition and distension. There are various modes of performance ; the lateral and bilateral ; the median ; the high operation, or supra-pubal ; the recto-vesical. For ordinary cases, the lateral is much to be preferred.

As early as the year 318 B.C., the ancients cut out stones, by incising the perineum freely, the stone having been made prominent there by fingers introduced within the rectum ; and this operation—"cutting on the gripe"—continued in use till the sixteenth century. In 1525, Johannes de Romanis, of Cremona, incised the bulb on a sound, prolonging the wound into the membranous portion of the urethra ; the neck of the bladder he then dilated by male and female conductors, until the wound was deemed sufficiently wide for the introduction of forceps and removal of the stone. This operation—termed, from its complexity, the method by the "apparatus major," or the Marian method, from the name of an especially eloquent advocate of its superiority to all others—continued in vogue until 1697 ; productive, however, of only indifferent success. In that year, Frère Jacques appeared ; the advocate of incision, as preferable to laceration ; at first cutting recklessly and ignorantly into the perineum, by an instrument very like a dagger ; afterwards operating with a common scalpel, and incising the prostate and neck of the bladder with scientific precision—having specially studied anatomy under Duverney at Versailles. This was the foundation of the lateral method ; afterwards practised with much success by Raw in Holland, and subsequently by Cheselden in this country—but not successfully by the latter surgeon, until he had recovered from mistakes into which he had been led, by the disreputably mysterious use which Raw had made of the knowledge which he obtained from the honest Friar.

We shall describe the lateral operation as ordinarily performed by modern surgeons ; and more especially as we were taught it by the late

Mr. Liston. From his high authority, in one point only would we venture to dissent. He was opposed to much preparation of the patient ; conceiving that delayed expectation of the event operates injuriously on the mind, and disposes to sinking, or at least to asthenic results. On the contrary, we think preparation quite as essential here as in the case of lithotripsy. We hold that it is necessary to subdue phlogistic tendency, to rectify general function, to quiet the bladder and system, and to amend the state of the urine—before the operation can be performed under auspicious circumstances ; and that such preparation ought invariably to be completed, whether the time occupied be of weeks or days. Among other items of management, the carbonates of soda or potash, in weak solution, not only may be expected to produce the good effects on the bladder formerly mentioned ; but besides, the urine, by their use become less acrid than usual, will prove less hazardous in the event of infiltration in the wound.*

The patient is placed on a firm table, of convenient height ; and is bound securely, hand to foot, by stout tapes. In no operation is anæsthesia by chloroform more suitable or safe. It is well to clear the lower bowel, the evening before, by an enema, or by castor-oil ; and the bladder should be moderately full of urine. A staff is passed, of as large a size as the urethra will conveniently bear ; grooved deeply on the convexity, a little to the left side.† It will be more readily introduced before than after deligation ; and the surgeon should be satisfied, before he proceeds a step further, that it impinges on a stone. If in doubt on this point, let him withdraw the staff, and introduce a sound. It is essential that the stone be felt immediately before the operation. Deligation over, and the staff satisfactorily passed, the patient's nates are brought to project a short distance over the end of the table ; and there he is to be secured by assistants ; one placed behind, with a hand on each shoulder, ready to oppose any involuntary movement away from the operator ; and one to each limb, holding them apart, and pressing each femur firmly down into the acetabulum, so as to fix the pelvis and at the same time fully expose the perineum. To the principal assistant, the staff is intrusted ; to be held very steady, in a vertical position, and hooked up against the pubes—as much space as possible being thus made between the membranous portion of the urethra and the rectum ; and the same assistant keeps the scrotum elevated. The surgeon, seated in front, at such a height as to bring his hand conveniently on a level with the perineum—and with all the instruments he is likely to require spread on a towel or tray on the floor by his side, so as to be within easy reach when wanted—introduces his left forefinger into the rectum, to make sure of its being empty, and to stimulate it to contraction. The knife—longer than the common scalpel, especially in the handle, and with the posterior two-thirds of the edge blunt—is then entered in the perineum—previously well shaved—

* An American surgeon, of great repute as a lithotomist, attributes his success not to any peculiarity in the mode of operating, but solely to his long-continued and careful preparation of the patient.

† The late Mr. Key used a straight staff.—(Treatise on Section of the Prostate in Lithotomy, London, 1824.) Dr. A. Buchanan uses and recommends a rectangular staff.—(Monthly Journal, Feb. 1848, p. 554.)

about an inch in front of the anus, on the left side ; and is carried downwards beyond the anus, passing about midway between that orifice and the tuberosity of the ischium, through the skin, fat, and superficial fascia. The forefinger of the left hand is then placed in the wound, and directed upwards and onwards ; with the double object of keeping the bowel out of harm's way, and dilating the space—pushing aside areolar tissue, but not tearing muscular fibre. With the knife's edge, the fibres of the transverse muscle of the perineum—if it exist—are divided, along with such fibres of the levator of the anus as resist the free onward passage of the finger. The groove of the staff is now sought for ; and the finger is moved freely, so as to dilate the outward wound sufficiently—a touch of the knife's point being applied, warily, to any resisting part. Behind the triangular ligament, and in front of the prostate, the finger nail is lodged in the groove ; and over it the knife's point is made to perforate. The knife, felt distinctly on the staff, is then pushed onwards in the groove, obliquely downwards and backwards ; so as to divide the portion of the urethra which intervenes between the point of the knife's entrance and the prostate gland, and also the anterior part of the prostatic portion

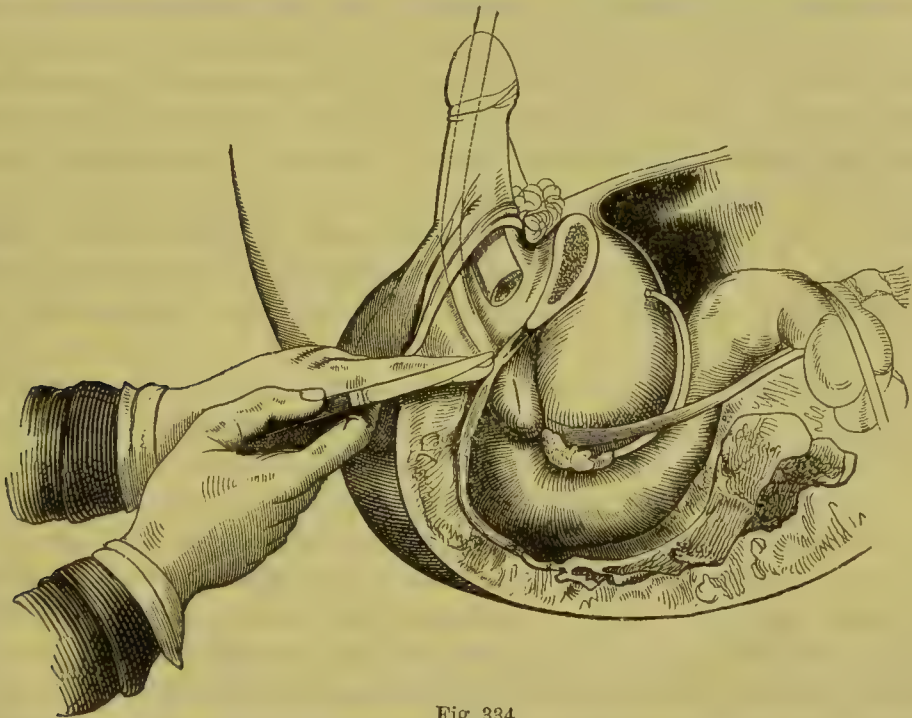


Fig. 334.

of the urethra. In other words, space enough is made for introduction of the finger, which follows the knife ; and the base of the prostate gland in its outer part is left intact. The finger, introduced and moved freely, increases the space considerably. And this dilatation of the wound is preferable to extensive incision ; there being much risk in cutting through the reflection of the ileo-vesical fascia, which is situate at the base of the outer aspect of the prostate, and which serves as an important boundary between the deep and superficial areolar tissue. By leaving this entire, the principal danger by urinary infiltration is shunned. And by dilata-

Fig. 334. Plan of the lateral operation of Lithotomy. The knife entering the urethra. The mark in the prostate is not intended. The right hand, too, is in the reverse position of what it ought to be.

tion of such a limited wound as now described, ample space is afforded for the introduction and play of forceps, and for the extraction of ordinary calculi.* Large stones require particular expedients, to be afterwards explained. In fact, the rule in this lateral operation is, to have a free external wound, and a small internal one ; the latter, when dilated, extending from the point of puncture in the membranous portion of the urethra, to the base of the prostate ; the former varying in extent according to circumstances ; always large and free, and largest when either a deep perineum or a bulky stone is expected to be encountered ; for, the yielding of the surface both gives room and diminishes depth, in the work of extraction, as well as in the formation of the deep wound. In withdrawing the knife, some little care is necessary, lest the edge should inadvertently come too near the ramus of the ischium, and endanger the pudic artery.

The making of the deep wound requires deliberation and care ; and it is expedient that the points of the finger and of the knife should move together, in order to secure exactness. In athletic adults, naturally of a deep perineum, and who are not in a state of anæsthesia, difficulty may be experienced at this stage by a straining of the muscles, whereby the bladder is elevated in the pelvis, and the parts consequently removed from the control of the finger. Under such circumstances, it were rash to proceed with the knife alone. The operator must withdraw this ; and, keeping his finger in the deep wound, he should wait patiently until the straining or spasm has ceased ; establishing the full influence of the chloroform ; or reasoning with the patient on the propriety of his being as passive as possible—if he be not anæsthetized ; and resuming the operation, when the parts to be cut are again found to be within his finger's reach.

While the forefinger dilates the deep wound, the urine escapes more or less rapidly ; and we expect that the stone, descending in consequence, will be distinctly felt. Then the staff is gently withdrawn ; by means of the finger moving in contact, a more precise idea of the nature of the stone or stones is obtained—as to size, number, shape, and position ; and to the circumstances thus ascertained, the subsequent proceedings are adapted. If, for example, the stone be found of larger size than what the surgeon knows will pass readily through the aperture he has already made, an addition of space may be gained, without tearing, and without the division of any parts which it is expedient to retain entire—by passing a straight probe-pointed bistoury over the fore-finger retained in the wound, dividing the prostatic region of the urethra on the right side, to the same extent as on the left, and then renewing dilatation. When the stone is expected to be of considerable size, the surgeon should be prepared to adopt this bilateral incision from the first.

The wound being deemed sufficient, and the finger being in contact

* Too sparing a wound of the prostate is also to be avoided ; otherwise sufficient space can be obtained only by tearing. A dense unyielding structure, demonstrated by Liston, Syme, and others, at the posterior part of the gland, must be divided, in order to admit of easy dilatation. *Vide* Liston's Pract. Surgery, last edition, p. 510 ; also *Lancet*, No. 1132, p. 515, May 10, 1845.

with a stone of ordinary character, forceps are introduced, for seizure and extraction. These should be, in length of handle and capacity of blades, proportioned to the size of the stone; the object being, that the blades shall embrace the calculus at as many points as possible, and that the handles shall be long enough to give a full power in extraction. The blades are partly lined with calico, so as to diminish the chance of the stone slipping from their grasp. An instrument, suited to the stone, having been selected, is passed over the finger to the deep wound; and, as the finger recedes from this, the forceps enter and come in contact with the stone. If this is not at once felt, the handles should be elevated, so as to depress the blades to the part of the bladder where the stone is most likely to be. The blades are opened, and, by a catching movement of the instrument, seizure is effected. If any suspicion exist that a portion of the bladder may have been included along with the stone, the instrument is turned round and round so as to test this; freedom of movement implying freedom of the bladder. Seizure having been accomplished, the axis of the forceps is changed; the point is raised, and the handles are depressed. The forefinger is then re-introduced by the side of the instrument, and between the blades, to ascertain in what direction the stone is placed, and to rectify the position if necessary. For example, if an oval uric calculus have been seized in the transverse direction, it will not pass through the deep wound without much violence, if at all. The jaws of the instrument are slightly relaxed; and with the forefinger's point the stone is gradually and carefully shifted, until the long diameter presents to the wound. Then the extracting force is applied; pressing the handles to each other as much as is necessary to prevent slipping of the stone, and not so much as to endanger its being broken; directing the handles, and consequently the extracting force, according to the axis of the pelvis—obliquely downwards—not jamming the blades beneath the arch of the pubes; and moving the forceps antero-posteriorly, so as to gain room by further dilatation. By pressure of the finger, the bladder is prevented from descending along with the stone; or, in other words, counter-extension is made to the extension of the forceps; fixing the bladder, and allowing extraction to be made more effectually than it otherwise would be. After having passed the prostatic wound, resistance may be offered by fibres of the levator of the anus—insufficiently divided by the incisions; this obstacle may be overcome by the finger also; or it may be necessary to notch the resisting fibres by the edge of a probe-pointed bistoury.

In the case of a number of small stones, the metallic scoop will be found generally preferable to forceps. The instrument is first used as a sound, passed through the wound; the stone, having been found, is moved towards the opening in the bladder; and then—if not before—being brought in contact with the point of the forefinger, is withdrawn—steadied on the scoop by the finger's pressure.

Sometimes the stone is lodged above the pubes, and refuses to descend. In such a case, curved forceps are of use; but the difficulty is of rare occurrence. Bent forceps may also be useful, when, in an old man, the stone is lodged in a deep pouch of the bladder, behind a prostate very much enlarged.

The stone may be encysted ; a part only projecting into the bladder. The forceps seizing the projection may bring the whole away ; if not, it will be necessary—when the part is within reach of the finger's point—to dilate the cyst's orifice slightly, by a probe-pointed bistoury. If the stone be firmly impacted, and not to be loosened safely by the bistoury's edge, the operator must have recourse to expectancy. The wound is occupied by a full-sized tube ; and, during the suppurative stage that follows, it is hoped that the textures may relax, and the stone be disengaged. Then it may be removed in the ordinary way, as has been experienced. Fortunately, however, such a complication is of rare occurrence.

On one occasion, in contending with an encysted or sacculated stone, it was found impossible to seize the stone otherwise than with the coats of the bladder in which it was held. Retaining it thus by the forceps, bringing all down within reach of the finger, and with this pushing back the soft parts gently while the forceps yet kept their hold, the stone was extracted.*

Should the calculus break and crumble under the forceps, the scoop will be found well adapted for removing the fragments. And in such cases, to make sure that nothing is left behind, it is well to wash out the bladder. This may be done in two ways ; by means of an ordinary enema-syringe, the tube being introduced by the wound ; or, by means of a syringe and catheter—the latter introduced by the urethra—a powerful stream being made to issue by the wound, while the patient is placed in a sitting posture.

The stone or stones—readily felt by the finger, forceps, or scoop—having been removed, the searcher is introduced—a metallic sound, with a large bulbous extremity ; and by this each part of the bladder is carefully explored, in order to make sure that no stone or other foreign body remains behind. It is also useful to examine the stones themselves ; if one be removed, and found smooth, or hollowed, at one or more points, we may be tolerably certain that there is at least another in the bladder ; if, on the contrary, a stone is found rough and unrubbed at all aspects, we may conclude that it is solitary. Then a gum-elastic tube is introduced, and retained by tapes fastened to a bandage round the belly ; the tube being of length sufficient to admit of one extremity projecting from the outer wound, while the other is lodged in the bladder ; and of diameter sufficient to afford a free escape to both blood and urine. The nates having been sponged and wiped, the patient is unbound and lifted into bed ; and is there placed with the shoulders elevated, so as to favour outward passage of urine, by sloping the track of the wound. The knees are elevated, and placed slightly apart—supported in the ham, if need be, by a pillow ; and an oil-cloth and sponge are comfortably arranged for the reception of urine and protection of the bed-clothes. If much pain is complained of, an anodyne is given ; and henbane is preferable to opium, being less likely to interfere unfavourably with secretion of urine. The regimen is antiphlogistic for some days ; and plenty of diluents are given, so as to favour diuresis ; barley water, for example, is taken *ad libitum* ; and it may not be amiss to medicate it slightly

* Monthly Journal, Feb. 1848, p. 574.

with the alkaline carbonate, so as to ensure the urine being bland as well as plentiful. Copious "wetting" is always a favourable sign ; denoting a healthy condition of the kidneys, absence of febrile disturbance, and but slight risk of dangerous infiltration.

The tube is retained, until there is reason to believe that the margins of the wound have become "water proof," by consolidation and glazing consequent on plastic product ; the object of this instrument being two-fold—the prevention both of urinary infiltration, and of accumulation of blood within the bladder. It is also useful in the event of hemorrhage from the deep wound, as will be stated immediately. During the first few hours, an assistant should frequently introduce a quill, or other suitable instrument, for the purpose of preventing occlusion of the tube by coagulated blood ; but when the urine is coming clear, this precaution may be dispensed with. No dressing of the wound is necessary until the tube is out ; and then simple water-dressing, afterwards medicated as circumstances indicate, is all that is required. When we wish to remove the tube, it is sufficient to cut the retaining tapes ; and this may be done after twenty-four hours in the young, but not till nearly twice that time has elapsed in the aged—the plastic process being much more speedy and perfect in the one case than in the other.

After withdrawal of the tube, the wound contracts by the ordinary process of healing. And, after about eight days—sometimes sooner, sometimes later—uneasy sensations are begun to be complained of in the urethra, betokening restoration of its function as to the passage of urine. The first flow by the natural channel is partial, and accompanied with pain ; day by day, less and less comes by the wound, and the uneasy sensations in the urethra disappear. Ultimately the wound heals, and all is normally re-established. If any unusual delay occur, it may be necessary to pass a catheter gently ; in order to ascertain the state of the urethra, and clear away obstruction if necessary ; at the same time inviting the flow to its original course.

During the after part of the treatment, diet is gradually amended, as circumstances indicate ; the erect posture is resumed, and the patient may be permitted to move about a little, even before the external wound has quite contracted. Such medical treatment, by hygiene, will be continued, as is suited to prevent recurrence of the diathesis on which the stone's formation depended. The operation, in many cases, seems to have the effect, not easily explained, of changing the system wholly in this respect—reproduction of stone, after well-performed lithotomy, being by no means common ; yet it is well in all cases, by maintenance of due prophylaxis, to leave no means untried of preventing so unpleasant a relapse.

Such is the usual result of an ordinary and successful case of lithotomy. But there are risks and casualties which now fall to be considered.

I. *Hemorrhage*.—If there be a transverse artery of the perineum, of any considerable size, it may be troublesome by bleeding ; it cannot be avoided in the incisions ; but it can very readily be secured by ligature. By attending to the following circumstances, wound of the artery of the bulb will be avoided, when that vessel follows its ordinary course ; making

the free external incision of no greater depth than the superficial fascia ; cutting afterwards on a low level—sloping the main wound obliquely upwards, from the level of the anus to the membranous portion of the urethra ; never using the knife but with its back directed upwards ; using the finger, to dilate, more freely than the knife to cut, in making the deep wound of the perineum ; taking care to enter the knife's point, in the groove of the staff, behind the bulb ; and, at this part of the operation, invariably moving the knife from the operator, with its back towards him. If the artery follow an unusual course, it may, perhaps, be detected and avoided ; when the surgeon adopts the safe and good practice of invariably preceding and accompanying his knife's point with his finger. When the vessel is wounded, three courses are open ; to attempt deligation at the cut point—difficult, but not impracticable ; to pass an aneurism needle round the trunk of the pudic, on the inside of the ramus of the ischium, securing it by ligature there—also difficult, yet possible ; or simply to apply pressure to the vessel in the latter situation, by an assistant's finger placed either in the wound or in the rectum—maintaining such pressure by a relay of assistance, until bleeding has ceased. Or an acupressure needle may be employed to secure the same object. Veins or small arteries may bleed to excess in the neighbourhood of the prostate—especially in the aged. This form of hemorrhage is readily restrained by pressure ; pledgets of lint being introduced firmly into the deep wound, along the tube—and retained, if need be, by a T bandage. This is one of the important uses of the tube ; its presence, as an open conduit for the urine, admitting of such plugging being made with perfect safety as to the chance of urinary obstruction and infiltration.* Arnott's fluid dilator is also well calculated to be a successful compressing agent in such bleeding ; the open tube occupying the centre of the apparatus, and the compressing fluid consisting of cold water. By cold and pressure it is doubly hemostatic. A common lithotomy tube, too, surrounded by a sponge wrapped up with cord—sponge-tent fashion—will be found not inefficient.

Secondary hemorrhage sometimes occurs in the aged, in consequence of asthenic ulceration in the deep wound ; this requires ordinary hemostatic treatment by general means.

II. *Peritonitis*.—This is the result of inflammatory accession in the deep wound, extending thence to the coats of the bladder, and from the outer coat passing to the general peritoneum. Or it may be occasioned by violence directly done to the bladder, by forceps or scoop. It is accompanied by its ordinary signs and symptoms ; and is amenable to the ordinary treatment—leeching or venesection, calomel and opium, hot poultices and blisters. It is obviated by taking care, in dilating the deep wound, not to tear ; by not bruising or tearing the vesical coats in any part, through inadvertent seizure by the forceps or scoop ; and by never operating while the bladder is in an irritable or excited condition.

* For obvious reasons, however, it is well to avoid such plugging if possible. The tube, no doubt, averts risk by urinary infiltration ; but the track of wound, and especially the neck of the bladder, is not likely to heal so kindly as if no such rough manipulation had been employed. Plugging for hemorrhage always affects the prognosis untowardly.

III. *Urinary Infiltration* is the most serious risk in lithotomy ; and the one of most frequent occurrence. To obviate it, the following points are of essential importance :—Maintain the reflection of the ileo-vesical fascia entire, at the base of the prostate ; that gland being not divided throughout its whole extent, by the knife. Make the general wound conical in form ; the base at the integument of the perineum ; the truncated apex at the prostate. Make the general wound also sloping in form, its fall being from the prostate obliquely downwards—cutting obliquely up to the bladder, not directly into it ; also arranging the patient's trunk in bed, so as to favour this sloping form, obviously so well calculated for the ready draining away of the urine. In using the finger in dilatation, avoid all laceration ; torn parts being but ill-disposed for rapid plastic formation. Retain the tube for the necessary number of hours ; and keep it clear from coagulum, or other source of obstruction. Farther, the risk by infiltration is certainly diminished, by not operating unless the urinary organs and general system are free from excitement, the kidney acting healthily, and the urine in a satisfactory condition ; and also by maintaining, after the operation, a supply of urine which is bland as well as copious—mainly aqueous, and containing but a sparing amount of saline matter. For, if infiltration do occur to some extent, it will be less hazardous to part and system under such circumstances, than if the infiltrated fluid were the acrid and scanty urine of fever or of renal disease.

Urinary infiltration is indicated by the following symptoms :—A hot pain is felt in the site of the deep wound, thence creeping up the left hypogastric region, which by and by becomes tender on pressure ; the pulse grows rapid and weak—denoting constitutional irritation, not inflammatory fever ; the skin is hot and dry ; the tongue and lips are parched and dark-coloured ; the wound is dry and glazed in its edges, afterwards emitting a foetid sanies ; and the secretion of urine is in great measure arrested. Ultimately hiccough comes on, the abdomen grows tympanitic, and the patient is carried off in typhoid prostration. The local changes are—sloughing of the infiltrated areolar tissue, under an asthenic inflammatory process ; with thin, foetid discharge.

Treatment is by the ordinary means, adapted to bear the system through the irritation dependent on such a cause. And if the wound do not seem free and sloping enough, that defect may be remedied by enlargement of the external incision at its lower part. At first we may be for some time uncertain whether the case is one of this nature, or peritonitis ; and then a sparing application of leeches over the tender hypogastrium is expedient. After infiltration is declared, however, further spoliation or depression is quite unwarrantable. By some it has been thought advisable to enlarge the wound, and to divide the rectum at the same time, by the sweep of a curved bistoury ; on the principle of freely incising the infiltrated parts, and permitting the noxious fluids a ready outlet.

IV. *Urinary Infiltration and Peritonitis may occur together* ; an unhappy combination—known, or at least suspected, by a blending of the signs and symptoms of each. In treatment, it is perplexing to determine whether the one disease shall be more considered than the other.

But it is, perhaps, a safe general rule, to award pre-eminence to infiltration ; treating it much in the ordinary way ; in other words, endeavouring to support the system at all hazards, and hoping to afford it an opportunity of struggling through.

V. *The Wound may Inflammé untowardly* ; suppurating copiously ; perhaps sloughing. This is dangerous to a weak frame, by reason of the grave amount of constitutional disorder which attends, more especially when the deep part of the wound is much affected ; the patient may sink under inflammatory fever ; or he may afterwards succumb to hectic. The inflammatory access is obviated by care in the use of the finger and forceps while operating—neither tearing nor bruising ; and it is treated by ordinary antiphlogistic means—cautiously, with a view to the coming chance of hectic tendency under a long open and discharging wound. For, the sloughs must separate ; enlarging the wound, and necessarily delaying greatly the process of cure.

VI. *Cystitis* is to be obviated, by operating only in a quiet state of the bladder ; by avoiding bruise of the prostatic wound ; and by using the forceps and scoop with all gentleness, in reference to the coats of the viscus.

VII. *Aggravation of Renal Disease*.—Plain indication of organic disease in the kidney is in most cases held sufficient to contra-indicate the operation. But the symptoms of this, obscure and masked, may have deceived the surgeon. In such circumstances, the aggravation following on the operation will be subdued with difficulty ; the patient will in all likelihood perish.

VIII. *Constitutional Irritation* may prove dangerous in one of two forms :—1. As a *Shock* ; the immediate consequence of the operation. This may occur to a grave extent, as after other severe operations ; and the patient may never rally—death taking place within twenty-four hours, by sinking. Or *Hectic* may ensue ; in consequence of the wound remaining long open, and emitting a copious discharge ; as is apt to occur after inflammatory access in a weakly patient. Then we have to invite restoration of the urethral flow, by cautious use of a catheter ; to favour closure of the wound, and diminution of the discharge, by suitably stimulant dressing ; and to maintain the powers of the system, by the general treatment adapted for hectic. Sometimes, this state of matters has been found dependent on the presence of another stone within the bladder, preventing closure of the internal wound ; overlooked in the operation ; or, perhaps, since descended from the kidney. Under such circumstances, it is our duty to dilate the wound, and to obtain extrusion of the stone by the scoop or forceps.

IX. *Erysipelas* may occur ; extending from the wound to the nates and thighs, as well as to the perineum and abdominal parietes. It is obviated, by not operating unless the primæ viæ are in a satisfactory condition, and by great attention to cleanliness ; maintaining a proper staff of attendants, who keep the patient dry, clean, and as comfortable as circumstances will allow.

X. *The Wound may become Fistulous*.—It may contract to a certain extent, and then remain stationary ; a portion of the urine continuing to pass through the fistulous track. This remote result is more trouble-

some than dangerous. The urethra will most probably be found at fault—obstructed in some part of its course by former stricture, or by recent swelling; and the catheter or bougie has to be used accordingly. After due clearance of this canal, the perineal fistula will probably close. If not, it is to be treated as obstinate fistulæ usually are; by application of a hot wire, at long intervals.

Rectal Fistula sometimes results, by wound of the bowel at the time of the operation; or it may be caused more remotely by ulceration. The aperture may close, with the rest of the wound. But not improbably it remains open; fæces finding their way upwards into the track of the general wound, and urine passing into the rectum. Such a casualty is obviated by care, during the operation, in interposing the left fore-finger between the knife and the bowel, and always using the former most cautiously. Treatment consists in dividing the coats of the bowel up to the aperture, as in fistula in ano; but this is not done at once; an opportunity is first afforded for spontaneous closure.

Such are the more important and ordinary dangers and difficulties which attend this operation. We are constantly liable to meet with others, however, which can scarcely be brought under any categorical arrangement; and yet for them the surgeon must be at all times prepared.

The operation of lithotomy, in itself difficult, beset with many dangers, and implicating important parts, cannot be expected to prove very highly successful, even in the most skilful hands. The average proportion of deaths, hitherto—in the general practice of surgery—may perhaps be stated at one in five or six.* But as our science and art advance, it is to be hoped that the result will rise proportionally. Some individual operators have attained to pre-eminent success in this department; a pre-eminence apparently due, partly to operative dexterity and skill, partly to careful and judicious treatment both before and after the operation, partly to a careful selection of cases. The age of the patient has much to do with the prognosis. In childhood, recovery is the rule, death the exception. And the hale old man is more favourably situated than the robust and young adult. As a general rule, however, the chances of recovery diminish with increase of age—as well as with increase of size in the stone.†

Varieties in Lithotomy.

In young children, the operation may be done with a common scalpel. And it is essential to remember that in them the bladder rises comparatively high. The rectum is then the predominant viscus of the pelvis; and great care must be taken accordingly not to injure it by the knife. The patient may be exempted from deligation; held firmly on the table or upon an assistant's knee.

The Bilateral Operation.—When the stone is known or suspected to be of large size—too large to pass through the ordinary single wound of the prostate, but not too large to pass through the outlet of the pelvis

* In a recent table the average is stated as 1 in 6.62. *Lancet*, No. 1534, p. 71.

† *Vide Monthly Journal*, Nov. 1847, pp. 325 and 326.

easily—the wound is made *bilateral*, as has already been explained. But such bilateral section seems quite unnecessary in ordinary cases.

If, unfortunately, the surgeon have been deceived as to the bulk of the stone; and, after having made his bilateral section with perineal wound, finds that the calculus is too bulky to pass, even were it out of the bladder—he must either proceed to the high operation, or attempt to break the stone, and extract it piecemeal through the perineum. The *crushing* instruments, necessary in such circumstances, need not be described. They are to be found in cutler's shops, and in the armamentaria of most lithotomists; but, fortunately, are seldom, if ever, called into exercise. The simplest form of instrument is probably the best; strong forceps, the blades armed with teeth, and the handles approximated by a powerful screw. The operation *à deux temps*—cutting into the bladder one day, and attempting to extract the stone on another, during suppurative relaxation—is wisely abandoned; unless in the case of obstinately encysted stone, already alluded to. In no other circumstances is such a plan of operation voluntarily adopted; but it may be thrust upon an operator by the stern force of circumstances.

The *Gorget*, too, is but little used in the present day. For the blunt gorget, the operator's forefinger of the left hand is a very superior substitute, as a guide and conductor of forceps into the bladder. And the cutting gorget, however modified, can never be so certain or so safe, as a knife's point guided and controlled as we have endeavoured to describe.* In the hands of the careless or inexperienced, a cutting gorget may be the cause of frightful accident. Pushed recklessly on, it is as likely to be out of the bladder as in it. It may pass—has passed—between the bladder and os pubis, pushing up, bruising, detaching, or tearing the peritoneum; or between the bladder and rectum—as has more frequently been the case; in either way favouring the most hazardous infiltration, and perhaps combining this with peritonitis. It has happened indeed, that by a more heroic thrust, the bladder has been completely perforated, the intestines have protruded, and after death the liver has been found impaled!

The *Median Operation* is employed in some cases where the calculus is small, but unsuited for lithotripsy. The instruments required are a staff grooved centrally upon the back, a bistoury, and a pair of narrow-bladed forceps. The incision is made in the middle line of the perineum, in front of the anus, over and behind the site of the bulb. After dividing the fascia, the bulb is elevated; and the knife, entered in the groove of the staff immediately behind, is pushed onwards, till checked by the termination of the instrument. The finger is now conveyed into the wound; and, as the staff is withdrawn, maintains the patency of the urethral aperture. The forceps are carried into the canal over the back of the finger; and, having passed them onwards into the bladder, the calculus is laid hold of and extracted; after which a tube is placed in the wound.

The *Recto-vesical* operation is out of date. It was supposed that, by

* Gorget-like knives have been invented, for the purpose of rendering the prostatic wound very exact in its limits. But after trial they have been laid aside, as inferior to the ordinary knife guided by the finger.

cutting through the rectum, and thence reaching the posterior part of the bladder uncovered by peritoneum, less hazard would be incurred of peritonitis, hemorrhage, or infiltration. But the misery and even danger of a foul fecal fistula remaining, was found by much to outweigh the supposed safety of the procedure. Under certain circumstances, however, such an operation may be thrust upon us; as in the case narrated by Mr. Liston, where a large stone was found encysted in the posterior part of the bladder, and bulging into the rectum. In that case, after the ordinary opening had been made into the bladder, it was found impossible to dislodge the stone without division of the anterior wall of the cyst; and that could not be accomplished, without incising the corresponding portion of bowel. Then the stone was readily extruded.* Recently this operation has been revived; silver sutures being employed to bring the edges of the incision into accurate apposition (as in vesicovaginal fistula) with the view of obtaining union by the first intention.

The High Operation.—When a stone is deemed too large to pass with safety through the outlet of the pelvis by the perineum, it is to be sought for above the pubes. By a blunt staff, introduced along the urethra, the fundus of the bladder is elevated as much as possible in the pelvis, so as to enlarge the space uncovered by peritoneum on the lower and anterior aspect. A suitable wound is made through the abdominal parietes; entering the knife immediately above the symphysis pubis, and carrying it upwards as far as seems necessary; cutting layer after layer, cautiously, until the vesical coats are reached, and secured in contact with the external incision by means of a sharp hook. The coats of the bladder are punctured at the lowest part of the wound; and, the finger having been introduced into the viscus, the aperture is enlarged to the requisite extent. The stone is seized by forceps, and removed. The wound is brought together, having a short tube—or a slip of lint, syphon-like—at the lower part, by which the urine may pass readily away, and infiltration be avoided. To aid in this indication, the patient is laid on his side; and perhaps a flexible catheter may also be passed by the urethra, and retained. But with every care, it is difficult to prevent this grave accident—so likely to occur from the non-dependent nature of the wound. And, consequently, the results of this operation are not found to be very encouraging.

Recently, an important modification has been suggested; the premising of a perineal puncture; a track of wound resembling that of lateral lithotomy, but on a smaller scale; the internal opening implicating the membranous portion of the urethra only. Through this puncture the elevating blunt staff is introduced, and may be worked more efficiently than from the urethra. After removal of the stone, a common lithotomy tube occupies the place of the staff in the perineal wound, and is retained for some days, the urine passing readily through it—the patient's trunk being slightly raised to assist in this. The supra-pubal wound is brought accurately together throughout its whole extent, by silver sutures, and union by the first intention hoped for. And thus the operation may be not only simplified in performance, but also the great danger by infiltration may be effectually avoided.

Lithectasy.—Another recent proposal is the substitution of lithectasy

* Liston's Principles of Surgery, 2d edition, p. 657.

for lithotomy; that is, wound of the membranous portion of the urethra, and gradual dilatation of this—for wound of both this and the prostatic portion, dilatation and extraction following immediately. Lithotomy is performed on a small scale; or a puncture is made in the central space of the perineum, above the anus. The membranous portion of the urethra is reached and opened as in the Median operation. No attempt is then made to reach the bladder and stone by the finger, but the wound is occupied by sponge-tent, or by Arnott's fluid dilator; and thereby dilatation is effected more or less rapidly. In the course of twenty-four hours, the space may be expected to be suitable for the introduction of instruments, and for removal of a small stone—the neck of the bladder being left undivided, and the great hazard by infiltration being almost certainly avoided.* But the manifest objection to this proceeding is its slowness and uncertainty. Under tedious and painful dilatation the patient is very liable to suffer serious irritation, both mental and bodily; and a susceptible frame may be irreparably injured thereby. Also, after the allotted period of painful probation has passed, the space may be found insufficient; the dilator has to be resumed, or the knife is employed; and, in any way, danger is incurred. Further experience is yet required, ere the merits of this operation can be finally determined. But at present one naturally inclines to think, that it can be applicable only to small stones; and that these may be better dealt with by lithotripsy.

Palliation of Vesical Calculus.

We are called upon to palliate the symptoms of stone, irrespective of any operation, when the patient refuses to submit to this, or when the circumstances of the case obviously contra-indicate its performance. If the patient is far advanced in years, and suffers comparatively little from the stone, we decline to operate. When the patient is aged, and afflicted with great enlargement of the prostate—perhaps malignant—we cannot expect a successful issue; and the operation can scarcely be looked upon as a likely means towards Euthanasia. When the kidneys evince organic disease, by albuminuria, renal pain, constitutional disorder, purulent urine, etc., we cannot but fear that the operation will cause renal aggravation and death. In these cases, therefore, and such like, we content ourselves with palliating what we cannot cure. All violence and imprudence in exercise and regimen are avoided; the bowels are gently regulated; by alkaline or acid remedies internally, the condition of the urine and of the bladder is hoped to be amended; and by opiates, by the mouth or anus, pain is assuaged. When the phosphatic diathesis is not strongly marked, nothing proves more efficacious than weak doses of the alkaline carbonates much diluted.

Urethral Calculus.

Calculus in the urethra is sometimes original; foreign matter having been in some way introduced from without, and calculous deposit concreting on this as a nucleus. Much more frequently, however, it is

* WILLIS on Stone, p. 160.

secondary ; a vesical calculus having been arrested in its progress outwards. It may be simply impacted in the canal, which dilates behind it ; or it may become embedded in a cyst or abscess-cavity—sometimes formed of the urethral parietes, sometimes of condensed areolar tissue exterior to these. In the latter case, the symptoms may be slight ; there being little obstruction to the flow of urine. Impaction in the canal, on the other hand, causes much distress, by pain, frequent desire to make water, and imperfect ability to obey the call. If obstruction is complete, serious danger by retention of urine ensues. The calculus, when situated anteriorly, may be felt by manipulation in the course of the urethra.

Treatment varies according to circumstances. 1. If the stone be of considerable bulk, and arrested at the posterior part of the canal—and more especially if retention of urine exist—a catheter is to be introduced, by which the stone is dislodged, and pushed back into the bladder. There it can be afterwards dealt with by Lithotripsy. 2. If the stone be small, and situated anteriorly, it is to be brought to the orifice of the urethra, and thence extruded. Such forward movement may be effected by the fingers simply. Or a loop of wire may be insinuated past and behind the stone ; and thus it may be extracted, like a cork out of a bottle. Or it may be seized by small dressing forceps ; or—more readily—by Hunter's forceps. Or a bent probe may be passed behind, and by it extrusion may be effected, as in the case of foreign bodies lodged in the nose or ear. 3. But the stone may be fixed, and not inclined to move in any direction. Then it is to be cut out. If situate in the prostatic or membranous portions, the operation of lithotomy on the gripe may be had recourse to. The fingers of the left hand, passed into the rectum, push the stone forwards on the perineum ; and there, through a semilunar incision made across the raphé, above the anus, it may be extracted. Or lateral lithotomy may be performed on a small scale. And in having recourse to this latter operation, for a stone of some size, lodged in the prostatic portion of the urethra, and long resident there, it is well to remember that considerable alteration may have taken place in the bladder. It may have contracted completely on the stone ; the ends of the ureters abutting on this, and there being no cavity beyond ; the urine coming away constantly, by stillicidium. If a stone be found already in the perineal portion of the urethra, it is to be removed through a direct incision, made in the centre of the raphé ; and for this purpose, if a stricture staff can be coaxed past the obstruction, it is best and easiest to open the urethra to the requisite extent upon this. If the calculus present itself anterior to the scrotum, it is well not to excise it there ; for wounds in that situation are slow to heal, and apt to degenerate into troublesome fistulæ. By manipulation let it be brought behind the scrotum—if it refuse to advance to the orifice—and there let it be excised, through a deeper but more manageable wound. Not unfrequently a calculus, after having passed all the rest of the urethra, with more or less suffering to the patient, is arrested at the orifice. Thence forceps, or a bent probe, may remove it. But if such difficulty be experienced in the attempt, as to threaten laceration of the parts, let an incision be made to dilate the orifice, by means of a narrow probe-pointed bistoury ; and then extrusion will be simple and immediate. 4. Sometimes a cal-

culus, lodged in the urethra, works its way out by ulceration and abscess; presenting itself in the perineum or scrotum;—a tedious and unsatisfactory process, not to be wished for, or trusted to in treatment.

Preputial Calculus.—When the prepuce is congenitally long, and of tight orifice, and when the patient labours under calculous diathesis, a concretion may form exteriorly to the urethra, within the cavity of the prepuce; the urine being in some proportion retained there, after micturition, and having opportunity thus afforded for deposit. The symptoms are most manifest; painful and frequent micturition; congestion of the parts; the stone to be felt by manipulation, and also on introduction of a probe through the narrow preputial orifice. Treatment is simple. By a curved bistoury the prepuce is divided on its lower aspect; and by this simple incision two evils are at once remedied: the stone is dislodged, and the condition of phymosis is removed.

Prostatic Calculus.

The term *Prostatic* is not applied to a vesical calculus, which in its passage outwards has been arrested in the prostatic portion of the urethra; but is properly limited to those concretions which form in the ducts of the prostate gland. They are of small size, brown, smooth, and sometimes numerous; and consist of phosphate of lime, sometimes mixed with carbonate of lime, deposited from the secretion of the ducts. They produce more or less irritation at the neck of the bladder; especially after the bladder has been emptied. When they project into the canal, a sensation of rubbing may be felt when a sound passes over them. And, if in numbers, they may be felt sliding on each other, by a finger introduced into the rectum, and pressing upon the part. Whatever tends to vitiate and retain the secretion of the ducts, tends to the formation of such concretions. Hence they are generally met with in cases of tight stricture of the posterior part of the urethra. The ordinary result is one of two events. The calculus, reaching the orifice of the duct, drops back into the bladder, and may be either extruded thence, or remaining may constitute the nucleus of a vesical concretion. Or the stone or stones remain in the substance of the gland; perhaps leading to abscess and disorganization.

In the case of small projecting calculi, they may be dislodged by the end of a catheter; to be afterwards passed by the urethra, or to be ground by lithotripsy. And in the great majority of cases they may be passed readily enough, if no unnatural obstruction exist in the urethra. When numerous calculi lodge in the gland, a small lithotomy may be had recourse to—an operation, however, which is very seldom required.

Calculus in the Female.

As already stated, urinary concretions are comparatively rare in the female; for two reasons; because the calculous diathesis is less common; and because, the urethra being short, capacious, straight, and well-flooded, extrusion of renal formations is more probable than their retention. Nuclei are not unfrequently afforded, however, by the introduction of

foreign matter from without ; and these substances may be of bulk and form not favourable to extrusion under any circumstances ; bodkins, pencils, glass stoppers, coal, sandstone, etc.

When a stone does form, and remains, the symptoms it occasions are quite analogous to those in the male. Perquisition is made by a short, straight, steel staff, slightly curved at the extremity. And a stone, having been found, may generally be got rid of without incision. The urethra admits of great dilatation ; and if this be done gradually, but little pain is caused. Sponge-tent, Weiss's metallic dilator, or Arnott's fluid dilator, may be employed. And a sufficiency of space having been so obtained, forceps or a scoop are introduced, and the stone removed. The risk is that, in consequence of the dilatation, power of retention may be seriously impaired, and more or less inconvenience by incontinence of urine may result.

Lithotripsy was at one time considered unsuitable to the female ; but experience has shown that it is fully as applicable as to the male—the shortness and amplitude of the urethra favouring, indeed, the introduction and efficient play of the instruments. Subsequent expulsion of the fragments, too, is more easy and safe.*

If the stone be found of larger size than to pass by dilatation alone, and if lithotripsy should not be considered advisable, the knife is to be used—sparingly. A straight staff on the finger is introduced along the urethra ; on it a probe-pointed straight bistoury is passed ; and the urethra is notched, upwards and outwards, on each side—the knife's edge being chiefly applied at the neck of the bladder. Dilatation is then resumed ; and extraction effected. Where, however, the calculus has attained a size too great to admit of extraction through a curved incision of the neck of the bladder, the urethra and vagina may be laid into one, affording space for the removal of a calculus of any size. The incision should be afterwards treated upon the same principle as if it were a vesico-vaginal fistula, by approximating its raw surfaces by means of silver sutures.

A stone has made its spontaneous exit from the female bladder, into the vagina, by ulceration.

Sometimes calculous matter collects at the lower part of the orifice of the female urethra ; forming a concretion of greater or less size, which becomes imbedded in a partial dilatation of the canal—bulging into the vagina. The urine passes over it, freely but painfully ; it may produce most of the ordinary symptoms of stone ; yet, from its lateral and sacculated position, it may be overlooked in the introduction of a sound. It is a good rule, therefore, in cases of suspected stone in the female, to direct our attention to this part, after the bladder has been explored unsuccessfully.

* CIVIALE, *Traité Pratique et Historique de la Lithotritie*, Paris, 1847.

CHAPTER LVIII.

AFFECTIONS OF THE BLADDER.

Cystitis.

THE inflammatory process, attacking the bladder, may be acute or chronic ; and either form constitutes a formidable disease. *Acute Cystitis* may be the result of direct injury ; as in Lithotripsy or Lithotomy. Or it may be a continuation, or a metastasis, of inflammatory disease elsewhere, as in gonorrhœa. Or it may be of idiopathic origin. Or it may follow the use of internal irritants ; as cantharides. Most frequently it is the consequence of acute and ill-treated gonorrhœa. The symptoms are : pain in the region of the bladder, and also referred to the perineum and sacrum, sometimes stinging along the urethra ; tenderness over the pubes ; the urine voided very frequently, with great pain and straining—the pain being greatest after the bladder has been emptied ; the urine at first clouded with mucus, afterwards puriform in character ; sometimes, after the urine has passed, a small quantity of puriform matter is expelled with much suffering ; often the urine is mixed with blood ; sometimes, after scanty and turbid urine has passed, pure blood escapes, in drops or other small quantity. The system is involved in smart sympathetic fever. The affection may extend by the external coat of the viscus, and general peritonitis result. Sloughing of the whole thickness of the mucous lining of the bladder, leaving the muscular texture exposed, has sometimes been observed.

Spasm may simulate most of the symptoms ; but is known by absence of inflammatory fever, and by the character of the pain—which, in spasm, is sudden in its accession, not gravescent, rapid in its disappearance, and may be intermittent.

In the treatment of acute cystitis, antiphlogistics are to be plied actively. Blood is drawn from part and system ; fomentations and the hip-bath are used ; antimony, and if need be, calomel and opium are given ; opium, by the mouth and rectum, is usually indispensable—after bleeding—to subdue pain ; and the recumbent posture must be rigidly enjoined. This last indication is indeed imperative, in the treatment of all inflammatory affections of the bladder ; the erect and semi-erect postures tending obviously to favour determination of blood to the pelvic organs. The bowels are to be relieved by enemata, aided by the gentlest possible laxatives ; so as to avoid straining. During convalescence, the urine will probably require a special treatment ; varying, according as that fluid evinces an acid or an alkaline character.

Chronic Cystitis, or *Catarrhus Vesicæ*, is generally symptomatic of

some other affection ; of gleet ; of stricture ; of enlarged prostate ; of stone in the bladder ; of hemorrhoids, or other disease of the rectum ; of renal irritation. Sometimes, however, it is idiopathic. Micturition is frequent and painful, and the urine contains much viscid mucus. Often the recipient vessel seems almost entirely filled with mucus, thick, glutinous, and very adherent to the bottom. At first, it is greyish and streaked ; the streaks dependent on phosphate of lime ; afterwards it becomes brown, ammoniacal, and intensely foetid. Not unfrequently there is admixture of pus ; sometimes of blood. The mucous membrane is thickened and congested ; it may ulcerate ; the muscular coat is hypertrophied, and may sacculate ; the kidneys are sooner or later involved. By ulceration, it has happened that a communication between the bladder and rectum has been formed. Also, the fundus has become perforated into the sigmoid flexure of the colon ; constituting an entero-vesical fistula. The system is always affected more or less. And this is the diagnostic between catarrh and mere irritability of the bladder. In the latter, the system is comparatively free ; in the former, it is always involved, and in general seriously.

In treatment little benefit need be looked for, unless the obvious cause, when it exists, be removed. Stricture must be cured ; stone must be taken away ; the rectum must be restored to a healthy state. Disease of the kidney and of the prostate may be palliated, but is not always curable. For the disease itself, opium is of great service ; allaying irritation, and lulling inflammatory excitement. The buchu, pareira, and uva ursi, with mineral acids, are useful, as in alkaline urine from other causes. Regimen is generous, rather than otherwise ; to support the system. There is no tolerance of either purging or blood-letting. Iron often is of great use ; and perhaps the best form is the tincture of the muriate. From a combination of benzoic acid with copaiba relief sometimes results. And counter-irritation is often of the greatest service ; on the hypogastrium, perineum, or over the sacrum—the last the preferable situation—unless, indeed, there be already too much irritation there, in the form of bed-sore. In severe cases, the actual cautery may be warrantable ; to a very limited extent, however ; there being no tolerance in the system of the exhaustion and irritation of a large suppurating surface.

The following are some of the principal remedies :—Opium in full doses, and repeated, so as to overcome pain and irritation. If opium disagree, hyoscyamus may be substituted. Of the mineral acids, the dilute muriatic and nitric are usually preferred ; in doses of eight or ten drops, gradually increased. The pareira is given in decoction. Half an ounce of the root, in three pints of water, is boiled down to one pint ; and of this from eight to twelve ounces may be taken daily ; or it may be given in the form of extract, to the extent of twenty or thirty grains daily. Of the buchu and uva ursi, in the form of strong infusion, ounce doses are given three or four times a day. The buchu, however, seems sometimes to act more efficiently in the form of powder, administered by being suspended in water or mucilage. The tincture of the muriate of iron is administered, in doses of from eight to fifteen drops twice daily. A drachm of benzoic acid, with half an ounce of copaiba, made into an

emulsion with camphor mixture, may be taken in ounce doses, in the course of forty-eight hours.

The milder cases yield to such remedies. The more severe probably do not. In them, other measures must be had recourse to ; and the most promising is injection of the bladder—never to be employed, however, except in aggravated cases, and after ordinary means have failed ; otherwise it may itself prove the source of no inconsiderable injury. It is also essential that no acute or subacute exacerbation be present ; the disease must be thoroughly chronic. The injection is at first detergent and soothing ; water, or a decoction of poppies. Then a mixture of ten minims of dilute nitric acid with two ounces of distilled water is thrown in, and allowed to remain about thirty seconds. In two days the injection is repeated, and the dose of acid is generally increased ; by and by the injection may be given daily—not oftener.* In extremely chronic cases, the bladder may be thoroughly washed out by means of a double catheter, to the main orifice of which a Higginson's barrel-syringe is adapted, and by means of which a strong and continuous current is established in the viscus. Should at any time pain or even uneasiness follow the use of this means, however, the practice must be discontinued.

In very obstinate cases, it may perhaps be allowable to make a cautious trial of the application of nitrate of silver, in substance, to the mucous coat, as proposed by M. Lallemand. The bladder having been emptied, the porte-caustique is passed ; and the stilette having been pushed forwards, a momentary contact of the nitrate of silver with the lining membrane is permitted. The instrument is then withdrawn ; and a portion of the caustic, dissolved in mucus, pervades the viscus. This is to be done very warily ; and the after consequences must be anxiously watched, lest inflammatory mischief ensue.

Irritable Bladder.

In healthy states of the urine and bladder, the stimulus of the former operates on the latter only according to quantity ; a certain amount of fluid having accumulated, an uneasy sensation is felt, and the bladder contracts in obedience to that stimulus, seeking relief thereby. If the urine be abnormally acrid, however ; if the mucous membrane of the bladder be morbidly sensitive ; or, more particularly, if both these states exist together—the ordinary stimulus of the urine is found to be intolerable, and frequent, uneasy micturition results, constituting the affection termed Irritable Bladder. Pathologically, it differs from any form of cystitis, in depending on irritation, and not on the inflammatory process ; there is not necessarily any structural change in the coats of the bladder. Practically it is known by the absence of grave constitutional disorder, as well as by the absence of profuse secretion of vitiated mucus—the prominent characteristics of Catarrhus Vesicæ. No doubt, however, these affections may and do not unfrequently coalesce ; the irritation inducing an inflammatory process, and becoming

* For further details of the *lotura vesicæ*, see Monthly Journal, May 1850, p. 482.

merged therein. Concussion and compression of the brain are often associated, yet are regarded as distinct affections ; and so here.

The symptoms of Irritable Bladder are—frequent micturition, with uneasiness rather than actual pain ; the desire is almost constant, the slightest quantity of accumulated urine proving an unnatural stimulus to the irritable mucous coat ; and relief is obtained, on evacuation being completed. The pulse and general system are comparatively unaffected. The urine may be limpid and clear ; frequently it is clouded by mucus ; not unfrequently it furnishes deposit of the urates. The cavity of the bladder is contracted ; but not necessarily with structural change. In some cases, the coats have been found thinner than in health. The source of irritation may be in the mucous coat itself. More frequently it is elsewhere ; affection of the kidney—in phosphatic or oxalic diathesis, for example ; ascarides, hemorrhoids, or other disease of the rectum ; calculus, or other irritation in the urethra ; in children, it not unfrequently depends on a contracted state of the preputial orifice. Most frequently, the affection is found to originate in derangement of the kidney and of the general health ; and this at once gives the two component parts ; the acidity of urine, and perverted sensibility of the mucous coat. Indeed, these morbid states very seldom are separate ; for if irritation commence in the bladder, it is thence extended to the uro-poietic system, and derangement of secretion necessarily follows.

Treatment consists in looking for a cause, and in removing it, if possible ; amending the stomach, bowels, and general health ; and restoring the urethra, rectum, and other parts to a sound state. By anodynes, given by both mouth and anus—but especially in the latter way—the irritation is subdued. And, throughout, a constant regard is had to the state of the urine. The small doses of alkali, largely diluted, are often found very serviceable. Recumbency is advisable ; at all events in cases of severity. And should these simple means fail, recourse is had to smart counter-irritation ; by blistering above the pubes, or over the sacrum.

Mental anxiety induces a temporary simulation of this disease ; or, perhaps, it may be said to cause a variety of it. The mucous coat is increased in sensibility, and the whole frame is in unwonted excitement. The urine is not acrid ; on the contrary, it is copious, pale, aqueous, and bland ; and stimulates by quantity, rather than by quality. In this case, belladonna, hyoscyamus and other sedatives, are all-powerful ; together with attention to the manifest cause of the disorder.

Hæmaturia.

By this term is understood spontaneous discharge of blood from the urethra. It may proceed from different sources. 1. *From the Kidney.*—Stone in the kidney is often accompanied by discharge of blood from the mucous membrane in contact with the stone ; more especially after violent exercise, error in diet, or other source of aggravation in gravel. Blows on the renal region cause hæmaturia ; the blood in such a case sometimes passing in large quantity. Occasionally the occurrence takes place without any assignable exciting cause, in cases of structural disease of the organ.

The renal source of the hemorrhage is known, by the blood being diffused equably through the urine; by the expelled fluid containing cylindrical portions of fibrin, like small worms, the result of coagula in the ureter—sometimes colourless, sometimes of a pale pink hue; by the appearance of blood being preceded and accompanied by pain and heat in the loins, and other renal symptoms;—and more especially when such symptoms are present on one side only.

Treatment consists in such means as are best calculated to remove the cause; in the case of external injury, rest, fomentation, low diet, leeching if necessary; in the case of stone, the palliative or more thoroughly remedial measures, which we have already seen to be suitable in this disease; in the idiopathic bleeding, connected with a generally relaxed state of system, and threatening exhaustion by continuance, such remedies as are useful for passive hemorrhage—more especially rest, local application of cold, and internal use of gallic acid.

2. *From the Bladder.*—This is the most frequent variety; as already seen, a very constant attendant on vesical calculus; and then liable to be aggravated by circumstances. It may also proceed from a congested or inflamed state of the mucous membrane, unconnected with the presence of any foreign body. More or less, it is common in cystitis. From ulceration of the mucous coat it cannot fail to occur. But perhaps the most frequent source, next to that of calculus, is enlarged and ulcerated prostate. And if this state co-exist with calculus, the loss of blood is likely to be both large and frequent. Malignant tumour of the bladder as it ulcerates, must furnish blood; and a large amount may flow from injury done to the coats of the viscus, by ill-managed catheters, bougies, or lithontriptors. Worms lodge in the bladder; sometimes, though rarely; and they have been known to occasion profuse and even fatal loss of blood.

Vesical hemorrhage may be so profuse as to furnish blood tolerably pure from the urethra. And, in general, this variety of hæmaturia may be known, by the blood not being mixed with the urine; the latter fluid passes off first, tolerably pure; and the blood comes last, more or less changed by mixture with the residue of the urine. It is also known by the absence of renal symptoms; and by the presence of undoubted signs of stone in the bladder, or other disease of that viscus, or of affection of the prostate. In the case of direct injury done to the bladder by instruments, there need be no room for doubt. Treatment, varying according to the cause, is plain and obvious, and need not be particularized.

Sometimes blood escapes in large quantity—in the case of stone, or enlarged prostate—and accumulates in the bladder; coagulating, and causing retention of urine. A hard tumour is felt in the hypogastrium; the ordinary distressful signs of retention are all present; on introducing the catheter, only a small quantity of bloody urine passes off; the fibrinous clot may be felt plainly enough, on moving the instrument's point; and, on withdrawing the catheter, this is found more or less obstructed by coagulum. If the symptoms be not urgent, we may content ourselves with occasional introduction of the catheter, to remove what loose fluid there is; the coagulum gradually dissolves in the urine, and comes away. If urgency exist, however, it is advisable to inject a small quantity of

warm water ; and then, by the exhaustion of a powerful and well-fitting syringe, to endeavour to break down and remove at least some of the clot. When, however, this cannot be effected, while painful distension of the bladder and retention of urine continue, an incision of the membranous portion of the urethra in the middle line, upon a stricture staff, should be practised, through which a large-sized lithotomy tube is lodged in the bladder. In the case of spontaneous disruption of stone, attended with such complication, it is expedient to have instant recourse to lithotomy, provided the state of system be found sufficiently tolerant of such a severe proceeding.

3. *From the Urethra.*—In this case there is absence of both renal and vesical symptoms ; the blood passes pure, irrespective of any desire to evacuate the bladder ; and there is usually some plain cause for the accident—as injury, inflammatory access, erection in chordee, or excessive venereal excitement. The application of cold, with recumbency, usually suffices for arrest. In extreme cases, following chordee, pressure may be made on or near the orifice, and at the perineum ; so as to include the source of bleeding between the two compressed points—preventing escape in either direction, and converting the effused blood into its own hemostatic ; or a full-sized metallic catheter having been passed into the bladder and tied in, the pressure upon the urethra can be made still more accurate and efficient. In the case of wound, the ordinary principles of surgery are put in force.

Enuresis, or Incontinence of Urine.

Practically, this malady may be divided into that which affects the adult and the aged, and that which happens in children. In the former one of two events has taken place. Retention of urine has occurred ; the bladder has become greatly distended ; and the recently secreted urine, finding no room in the viscus, involuntary dribbling from the penis takes place proportioned to the rapidity of secretion. In other words, incontinence in this case is but a symptom of a more serious affection—retention of urine. Or, as more frequently happens in the aged, the parts have simply lost their tone ; the expelling power is small, while the retaining power is almost or wholly gone ; and the urethra is little more than a passive tube, through which the urine flows outwards, shortly after secretion. In the former case, treatment is by the use of the catheter ; directing our attention to the true disease—retention.* The other form is regarded as but one of the many signs of senile decay. Temporary relief may in some cases be afforded, by the internal use of iron and strychnine ; a degree of tone being restored to the parts for a time. But, in general, we have to content ourselves with attention to comfort and cleanliness, by the wearing of valvular urinals adapted to the circumstances of the case.

In the adult, incontinence of urine sometimes follows rheumatic or other fevers ; it may also result from injury of the spine ; and it is an ordinary symptom of the slow degeneration of the spinal cord formerly

* Called to a case of incontinence in the adult, the existence of distended bladder should always be suspected, and examination made accordingly.

spoken of. *Nux vomica* or *strychnia*, *cantharides*, and tincture of the muriate of iron, with blistering over the sacrum, are the most likely means of benefit. In some cases, the application of electricity to the parts affected has been of service. The remedies are plainly of that class which tend to restore muscular and nervous energy.

Enuresis in children is extremely common; very much allied to irritable bladder; but differing in this, that while, in the latter affection, evacuation of the bladder is voluntary, in this case it is involuntary. During the day, the child makes water with unusual frequency, perhaps; at night the urine is passed involuntarily; and this unpleasant habit may continue in adolescence. Corporal discipline may still be the favourite remedy among nurses, and with some parents; but it is as ill-judged, as it is cruel and unnatural: the child might as well be punished for club-foot or the measles. The involuntary escape of urine is the result of a morbid state, and requires curative treatment. Usually, the general system will be found out of tone; and this is to be obviated by the ordinary remedies; more especially by cold bathing, and by small doses of the tincture of the muriate of iron. At certain stated hours, during night, the child should be awakened for the purpose of emptying the bladder; if possible, he should be taught to sleep upon his face; and, at all events, he is prevented from sleeping on his back, and so exposing the most sensitive part of the bladder to contact with the urine. The bowels must be kept in good order; and the state of the rectum should be especially attended to. *Ascarides* may probably be found there; if so, they must be expelled. Certain means are supposed to have a special effect on the bladder. The *nux vomica*, or *strychnia*, is certainly of use; perhaps by allaying irritation, as well as by increasing tone at the neck of the viscus. The nitrate of potass has proved serviceable; and, in such cases, it is probable that the urine was scanty, acrid, and consequently unusually stimulant. In other cases, the more ordinary means having failed, benefit has accrued from *cantharides* internally; and in such cases, probably, there was a sluggish condition of the neck of the bladder and adjacent parts. The effect of this remedy has also been explained, by supposing that, acting as an irritant on the lining membrane of the urethra, especially at its posterior part, it produces turgescence there, so rendering the potential canal less easily opened up. Amendment has not unfrequently followed the application of a large blister over the sacrum; but whether by the principle of counter-irritation, or from sleeping on the back being thus effectually prevented, it is not easy to determine. Mechanical means—as the jugum penis—are not to be thought of.

It may happen that a boy, ashamed of his infirmity, and perhaps impelled by desire to escape corporal punishment, voluntarily has recourse to mechanical aid; and, at bed-time, constricts the penis by a ligature, or a curtain ring, or other suitable means which may occur to him. In the morning, he finds the parts swollen and painful; he is unable to remove the jugum; and, afraid of the consequences of a disclosure, he suffers in silence. The swelling increases; ulceration takes place; the foreign body becomes imbedded in the inflamed tissues; the penis may be gradually cut through; and, the urethra having been at

length reached, a calculus begins to be constructed there. Such cases have been recorded by Liston, Helot, and others. Contrary to expectation, the erectile capabilities of the organ do not seem to have been impaired by the gradual transverse section.*

If called to such a case, after some days, with the constricting agent sunk in inflamed parts, a free incision is to be made upon the offending body ; which, having been exposed, is to be divided—by knife or pliers, according to its nature—and removed. If called early, a tight ring may be taken off, as from the finger, thus : pass the end of a stout and long thread beneath it, leaving the pubal end loose and prehensile ; roll the rest of the thread tightly and closely round the penis in front of the constricted part, so as to invest it wholly ; then gradually unrol, from the pubal end ; and the ring is shuffled forwards, as the thread is made to uncoil.

Retention of Urine.

This serious calamity may arise from a variety of causes ; and treatment varies accordingly. The symptoms are : inability to evacuate any urine, while desire to do so is great, constant, and frequently aggravated—with straining, pain, and much distress. The bladder, rising in the pelvis, is felt above the pubes, and also by the finger introduced into the rectum ; pressure above the pubes causes great pain, and percussion is dull there ; in extreme cases, the bladder may become an abdominal tumour almost as large and distinct as the gravid uterus—oval, tense, and fluctuating. If the bladder have been previously contracted in cavity and thickened in its coats, the ordinary symptoms of retention may be occasioned by the incarceration of but a small quantity of fluid ; and then the tumour can be felt only by the rectum or vagina. In other cases, the bladder distends readily ; and the tumour may be both large and high in the abdomen, before unpleasant feelings are complained of. As the case proceeds, pain and straining, with sickness, become more and more unbearable ; the pulse rises, the skin grows hot, the tongue is dry ; breath and perspiration may evince an urinous odour ;—“urinous fever” is established ; absorption of the vesical contents has begun. By and by the ureters become distended, as well as the bladder ; increasing pressure is thus made upon the kidneys ; their secretion is arrested in consequence ; and suppression of urine, supervening on and caused by the retention, tends to produce coma and death.

If the bladder be relieved, the urgent symptoms disappear speedily ; the patient passes from torment into Elysium ; and under no circumstances will he be found more eloquently and sincerely grateful. He must be seen again soon, however, otherwise the unpleasant symptoms may speedily return. The kidneys, compressed by the enlarged and full ureters, had for some time been secreting little ; on removal of that pressure, the secretion is renewed copiously, and the bladder may be soon refilled.

* Lately, in operating on a little boy, on account of chronic paraphymosis, with preternatural opening of the urethra behind the glans, I found a tight piece of packthread deeply imbedded in the penis, and constituting the true stricture.

If no relief be afforded, a serious local accident is likely to occur before the system has become fatally prostrate. The bladder or the urethra gives way; either by ulceration, or by actual tearing under strong action of the detrusor; and extravasation of urine takes place—of urine, be it observed, deprived of much of its aqueous part, intensely saline and acrid. The inevitable result is sloughing of the infiltrated parts; too generally followed by rapid sinking of the patient. Obviously, therefore, it is of the utmost importance to afford early and effectual aid in this affection.

1. *Retention from Stricture of the Urethra.*—In this case, perhaps the most common, danger is especially great; the thickened and powerful middle coat of the bladder labouring hard to overcome the obstacle to evacuation, and consequently rendering solution of continuity all the more imminent.

The patient has long been in the habit of making water tardily and ill; at last the passage seems effectually closed; and the ordinary distress of retention supervenes. Probably an exciting cause may be found; indiscretion at the dinner-table, injudicious use of a bougie or catheter, exposure to cold or wet, or an attack of piles. The previously narrowed canal has become occluded by congestion, or by the swelling attendant on an active inflammatory process, in the affected part; and, no doubt, there is also spasm.

If the history of the case and its symptoms be such as to lead us to suppose that the strictured urethra is inflaming or inflamed, the catheter must be withheld; unless indeed the case be far advanced, and the safety of the parts from extravasation already endangered. Leeches are applied to the perineum, in clusters; or cupping is had recourse to; the patient is seated in a warm hip-bath—and this bath need not be delayed till leeching is over, as the animals will not be disturbed by comfortable immersion. A full opiate is given, by the mouth or by the anus; or in both ways. Very probably, such relaxation occurs as to obviate all necessity for the catheter; urine dribbling away in the bath, and then perhaps coming in a tiny stream, sufficient to relieve all urgency of symptoms. In the event of failure, however, after a reasonable time and trial, the bladder must be relieved at all hazards.

In those cases where we have no reason to suspect an inflammatory attack, the catheter is used at once; of small size, steadily yet gently persevered with; the patient under chloroform. Sometimes the silver instrument refuses to pass, while a gum-elastic one, straight, and deprived of its stilet, enters the bladder with comparative ease. Sometimes it happens, that after the end of a silver catheter has been pressed steadily for some time on the stricture, and withdrawn, the urine begins to follow. The steel probe-pointed catheter diminishing in size gradually from the size of a No. 3 catheter of the common scale, down to a small probe point, will frequently be found very serviceable in obstinate cases. In no case is force or violence to be employed. But, when unsuccessful with the catheter and the auxiliary means already noticed, the bladder must be relieved at all hazards—through the perineum, or by the rectum, as will afterwards be stated.

2. *Retention from Urethritis.*—The inflammatory process may attack

the urethra, independently of previous stricture; causing turgescence and occlusion. This may be the result of gonorrhœa, or of direct injury. Retention supervenes gradually; and there is time for antiphlogistic treatment. To this we trust; leeches, fomentation, hip-bath, antimony, etc.; withholding the catheter, if possible; inasmuch as its use, even though successful in relieving the bladder, must aggravate the inflammatory affection, and tend to repetition in a worse form. In such cases, when we are obliged to resort to the use of the catheter, a medium-sized instrument, about No. 5, or 6, should be preferred.

3. *Retention from Irritation and Spasm at the Neck of the Bladder.*

—This may take place, irrespective of the inflammatory process, or of organic change. In the dissipated, it is no uncommon result of a late carousal; calls to evacuate the bladder, it is probable, having been imprudently neglected. A hip-bath, with an anodyne—opium or hyoscyamus, by the rectum or by the mouth—will usually give relief. If not, a full-sized catheter is to be passed, gently.

4. *Retention from Priapism.*—Priapism is a common result of spinal fracture; and sometimes it occurs in connection with venereal excess. In the former case, when retention takes place, we cannot expect benefit from direct treatment of the cause; and we must use the catheter. In the latter, by opium and camphor, and antimony; by the warm bath; by an opiate enema or suppository; and by leeches to the part, if need be—we may overcome the erection, and avert the use of instruments.

5. *Retention from Abscess in the Perineum.*—Abscess forming here—in connection with stricture, or as a result of direct injury—may bulge internally, so as temporarily to occlude the urethra. Catheterism would be very painful, and not unlikely to cause rupture of the abscess into the urethra, whereby urinous extravasation might occur. The knife supercedes the catheter; the abscess is opened from without; instant relief follows; retention is overcome, and the morbid state which caused it is at the same time removed.

Similar treatment may be required, on account of an abscess forming in the body of the penis, as a remote result of venereal disease.

6. *Retention from Pelvic Abscess, or Cysts forming within the Pelvis.*

—Pelvic Abscess, bulging on the neck of the bladder, may cause retention of urine.* Treatment is conducted on the same principles as in the case of perineal abscess; withholding the catheter, or using it very warily; and puncturing the abscess, so as to at once remove both retention and its cause.

Retention may be simulated. The abscess may so compress the bladder as to prevent its distension; and consequently urine is almost constantly passing away in small quantity, from a collapsed viscus; while the abscess, forming a large, dull, hypogastric swelling, may be mistaken for the bladder largely distended. In one such case I thrust the catheter through the walls of the abscess, which was consequently evacuated through the urethra. The patient made a good recovery.

Simple or hydatid cysts may form within the pelvis, and by their pressure occasion retention. In such cases the retention should first be

* A case is narrated in the *Lancet*, No. 1431, p. 118.

relieved ; the cyst being afterwards treated as the circumstances and complications of the case may render prudent.

7. *Retention from Urethral Calculus.*—This occurrence has been already alluded to ; impaction of a calculus taking place in such a way as quite to occlude the canal. Three courses of procedure are open to us : We may by the catheter push back the calculus into the bladder, treating it afterwards by lithotripsy. Or we may at once remove it by direct incision. Or we may bring it to the orifice of the urethra, and thence extract it—by dilatation if necessary. If the stone is small, movable, and situate anteriorly, we prefer the last mode ; if it is impacted in the prostatic portion of the canal, we probably prefer the first. If it is of some considerable size, firmly impacted, and beyond the prostatic portion, we have recourse to excision. In all cases, however, it is well in the first place to relieve retention. For this purpose a small-sized catheter can usually, without much difficulty, be conveyed into the bladder past the stone. Indeed, in many cases, the existence of this is not detected till an instrument is passed to relieve the retention.

8. *Retention from Injury of the Perineum.*—1. Extensive bruise of the perineum may cause retention, irrespective of any injury done to the urethra ; the extravasated blood bulging inwards on the canal. In such a case, the catheter must be used, until by absorption the compressing agent has been diminished or taken away. 2. Again, injury of the perineum may induce inflammatory accession, either in the urethra itself, or in the parts exterior to it ; and, in the latter situation, abscess may form. The treatment advisable under such circumstances has already been stated. 3. When the urethra has been torn or cut, there is no room for delay ; retention must not be waited for ; the catheter cannot be too soon introduced. For, if the patient have made an effort to evacuate the bladder, before such introduction, urine will certainly have escaped at the injured part, causing all the deadly results of extravasation. And only by early introduction of the catheter—retaining it until consolidation shall have taken place at the injured part—can extravasation be avoided.* If the urethra have been completely torn across, there may be difficulty in passing the instrument ; nay, not improbably, the surgeon may be altogether foiled in his attempt to penetrate the vesical orifice—shrunk, retracted, and displaced. Under such circumstances, a free perineal incision must be made so as to expose the part ; and then the catheter is passed through and retained. It is surely much better to make a limited incision, with the view of preventing extravasation, than to be compelled to incise still more largely afterwards, for the escape of sanies and sloughs, after urinary infiltration has occurred.

9. *Retention from Paralysis.*—A paralytic state of the detrusor may be the result of accidental over-distension merely ; of spinal injury ; of general debility, as in fever ; or of senile decay. The ordinary call to evacuate the bladder having again and again been neglected, under circumstances of restraint, the sufferer, when liberated from these, will

* It is a good general rule, in all cases of serious injury done to the perineum, to pass the catheter very cautiously, immediately on being called to the patient. If the urine come away clear, it is a good omen, and a point is gained both in diagnosis and treatment.

probably find no urine coming in obedience to his utmost efforts at expulsion. The muscular fibre of the detrusor has been over-stretched, and, for the time, is paralyzed. The catheter cannot be used too soon ; and its introduction is to be repeated from time to time, never allowing any considerable quantity of urine to collect ; so that the normal dimensions of the bladder, and the wonted functions of its muscular coat, may be speedily restored. Should the return of contractility be slow and imperfect, strychnine or nux vomica may be given, or galvanism may be employed. *

In the case of spinal injury, the circumstances are very distressing ; for, in addition to retention being ever liable to occur, there is phosphatic degeneration of the urine, with more or less change in the lining membrane of the bladder. The prominent symptoms of retention, however, are probably less urgent than in other cases ; there being usually diminished sensation in the viscus, as well as impaired muscular power. Occasional relief, too, may come, by partial escape of urine ; for the abdominal parietes may act on the bladder when greatly distended and risen ; taking on themselves, in some measure, the lost function of the detrusor. Also, as the bladder changes in its coats, the middle one, becoming hypertrophied, may acquire an increase of power, so as to effect a partial evacuation ; and the muscular coat, which is not excited to contraction so long as the mucous one is in a healthy condition, acquires a degree of abnormal contractility. In such cases, treatment is mainly spinal. The catheter is used from time to time ; the usual means are taken to correct the depraved state of the uro-poietic system ; and, during convalescence, recovery of power in the muscular coat may perhaps be promoted.

In protracted fever, retention is not uncommon, often with incontinence. It is obviously of much importance to detect this condition, and by catheterism to prevent it ; otherwise a most injurious influence will be exerted on the already oppressed system, by absorption of the urine confined within the bladder.

In the aged, the detrusor, as other muscles, grows feeble ; and by reason of this, retention may occur. Relief is got by the catheter ; and something may be done in amending muscular energy—at least for a time.

10. *Retention from Diseased Prostate* ; it may be, from either an acute or a chronic enlargement of the gland. In gonorrhœa, the prostate is liable to the occurrence of acute swelling, with or without the formation of matter ; and this may be to such an extent as to shut up the posterior part of the urethra. Treatment is by antiphlogistics ; withholding the catheter, if possible. If abscess have formed, it must be evacuated externally, by incision ; as in the case of similar affection of the perineum. In chronic enlargement of the prostate, peculiar to advanced years, relief can be had only by the catheter. And an instrument must be employed of large curve, and at least two inches longer

* Probably the most effectual way of applying this agent is to introduce a silver catheter into the bladder, and a female catheter into the rectum, with its point resting on the recto-vesical parietes ; and to connect each of these catheters with one of the poles of the electric machine.—Monthly Journal, Aug. 1850, p. 174.

than that in ordinary use ; for, by the prostatic enlargement, as well as by elevation of the bladder when distended, very considerable elongation of the urethra takes place, and an ordinary instrument must necessarily fail to reach the bladder—as will afterwards be more fully explained. Sometimes, however, the instrument with a short and almost rectangular curve will be found to enter the bladder through the prostatic urethra easier than the catheter with the large beak. Failing the one, try the other.

It is in this form of retention that incontinence of urine is so apt to shew itself as a symptom. For years, perhaps, the bladder has been imperfectly evacuated ; a certain amount of residuary water has always lodged in that viscus ; and the amount increases ; at last, the bladder becomes completely distended, and the urine which comes fresh from the ureters—as surface water—dribbles over and is involuntarily discharged.

Very frequently, the kidneys become diseased. In such a case, the catheter must be used cautiously. Were it to be passed at regular periods daily, fully evacuating the bladder on each occasion, it is probable that the kidneys, thus deprived repeatedly, suddenly, and completely of the circumstances which had so long tended to restrain their secretion, would become untowardly excited, and fatal aggravation of the renal disease might ensue.

11. *Retention from Blood in the Bladder.*—If this occur in connection with spontaneous disruption of a vesical calculus, lithotomy is probably the best remedy, as already stated. In other circumstances, we have recourse to a full-sized catheter, with large eyelets ; and aid its action, if need be, by an exhausting syringe. The ordinary hemostatic means are at the same time had recourse to, to prevent continuance of internal hemorrhage.

12. *Retention from Malignant Disease of the Penis.*—As carcinoma or cancer advances in destruction of the penis, secondary glandular enlargements occur, both without and within the pelvis ; and, in consequence, the outlet of the bladder may come to be completely obstructed. Such retention we can only hope to palliate, and briefly to extend the now closely meted term of existence. The bladder is relieved by puncture above the pubes, and the aperture is kept pervious by means of a gum-elastic instrument.

13.—*Retention from Imperforate Urethra.*—This is a state of matters analogous to retention of the meconium by an imperforate condition of the anus. The perforation necessary to complete the canal cannot be too soon accomplished.

Retention of Urine in the Female.

The most ordinary causes of this affection are—pregnancy, tumours, paralysis, and hysteria. The gravid uterus is likely to compress the urethra ; more especially about the fourth month, when the tumour is considerable, and not yet risen out of the pelvis. Relief is by the flat catheter. Other tumours may compress and obstruct the urethra ; uterine, ovarian, vaginal. Here again, as well as in the case of paralysis—of frequent occurrence after delivery—the catheter is employed. But, in hysteria, this instrument ought generally to be refrained from.

Hysterical women very often labour under retention of urine, simply because they refuse the effort of volition necessary for expulsion of the bladder's contents. Use the catheter, and repetition of the retention speedily occurs, the cause remaining the same. But refuse the catheter, and allow distension to proceed, until the stimulus thereby occasioned becomes such as to compel the detrusor to its function; and then, by an effect partly moral and partly physical, the patient will find herself permanently relieved. There are obstinate cases, however, which resist this mode of cure; and, in them, care must be taken not to endanger the bladder, by an excessive withholding of the instrument.

Puncture of the Bladder.

This operation becomes necessary, when urgent retention of urine exists, and when by the catheter we have failed to afford relief. It may be performed in a variety of ways; by the perineum, by the rectum, or above the pubes. 1. *By the Perineum.*—This is suitable to all cases of obstinate retention caused by impassable stricture, or other obstruction of the urethra; the bladder is safely relieved, and the cause is at the same time effectually dealt with. The patient is placed in the position of lithotomy; a catheter of medium size is passed down to the constricted part, and its point is cut upon by direct incision, in the central raphé; behind the end of the instrument, we expect to find a bulging dilatation of the urethra on the vesical aspect of the stricture; this is pierced by the knife; and urine rushes out, affording complete relief to the bladder. Then the knife is carried forwards, so as to divide the constricted part of the urethra, as accurately and thoroughly as possible. That having been laid open, the catheter is passed on and retained; and thus a most effectual step is taken towards permanent removal of the stricture. The operation is avowedly difficult—the dilated portion behind being not always easily found, and it requiring great care to make sure that the incisions at the constricted part lay open the canal of the urethra; but when rightly performed, it is thoroughly sound in both its principle and results. If the probe-pointed small-sized stricture staff can be passed through the constricted portion of the canal, the division of the stricture and opening of the urethra behind the site of the constriction will be greatly facilitated, and rendered infinitely more safe. Where the instrument however cannot be satisfactorily passed through the stricture, an incision upon its groove, anterior to the seat of obstruc-

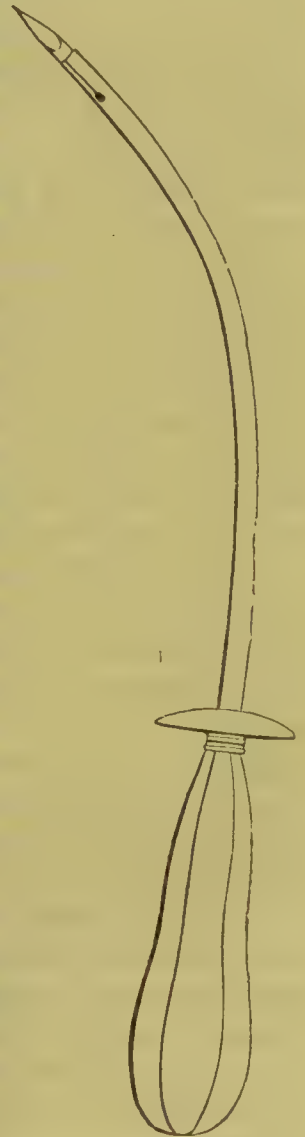


Fig. 335.

Fig. 335. Trocar for puncture of the bladder by the rectum.

tion, will frequently assist the surgeon materially by enabling him to introduce his finger as a guide in directing the staff through the obstructed part. It is rarely, however, that any such procedure is demanded of the experienced surgeon; generally he succeeds by the catheter and its auxiliaries—chloroform seldom omitted.

But this may be said to be puncture of the urethra, rather than puncture of the bladder; and so it is. In strict accuracy, perineal puncture of the bladder may be held to denote the reaching of the neck of that viscus, by the thrust of a trocar and canula, or by means of a small lithotomy wound—an operation which is very seldom performed for mere retention.

2. *By the Rectum.*—This is a simple and safe operation; but is apt to leave a troublesome fistulous communication between the bladder and bowel. We have recourse to it when foiled in the use of the catheter, and when the method by perineal incision is not considered advisable—or when that has failed; and, indeed, it may be performed in any case, by a surgeon who prefers it, except when the prostate is much enlarged. The patient is placed recumbent, with the limbs raised. The fore and middle fingers of the surgeon's left hand are introduced, well oiled, into the rectum; and their points are rested on the central space immediately behind the prostate. A long curved trocar is introduced by the right hand, with its stilet withdrawn within the canula; the extremity of the latter is fixed on the *trigone*, between the points of the fingers resting there; and, the stilet being then pushed forward, both the trocar and its canula are lodged in the bladder. The trocar is withdrawn, and the canula is retained. If there be good prospect of speedily removing the cause of retention, the canula may be very soon taken out. Otherwise, it should be retained for some days, so as to prevent premature closure of the wound.

3. *Above the Pubes.*—This is our last resource; when both the other methods are deemed impracticable. The operation is similar to suprapubic lithotomy. A small incision is made through the parietes, immediately above the symphysis; and through this the bladder is punctured at its lowest part, by means of a short trocar and canula—similar to what is used in ascites—directing the point of the instrument obliquely backwards, towards the promontory of the sacrum. The canula is left; or a portion of elastic catheter; or a short lithotomy tube. And the patient is laid on his side, so as to favour outward escape of the urine.

These methods of operation have been enumerated, according to what is conceived to be their merit. All are rare, in actual practice; and deservedly so; for none are of a favourable character. But any one of them is much preferable, at any time, to postponement of relief, and consequent disaster by extravasation; and all, too, are preferable to pushing a metallic catheter by sheer force through an impassably strictured urethra.

Extravasation of Urine.

This may be either vesical or urethral. The *vesical*, as we have already seen, may follow wound, ulceration, or tearing of the viscus. 1. After the wound of lithotomy, it is too common; 2. Cystitis may lead

to perforating ulcer ; 3. Retention of urine may be relieved only by a bursting of the bladder, or by a more gradual giving way by ulceration. Actual laceration, however, is not uncommon ; and it is not difficult to understand why. Cohesion of the parts has been previously diminished, by the inflammatory process occurring in them ; and, themselves unusually lacerable, they are powerfully acted on not only by a hypertrophied detrusor, but also by the muscles of the abdominal parietes and the diaphragm. 4. The bladder may be lacerated by external injury, acting either directly upon the fundus of the distended organ, or indirectly by succussion ; as by blows, or falls on hard substances, the breech being the part which comes in contact with them, more especially when the viscus happens to be distended. The nature and treatment of the first form has already been considered. The second is hopeless ; the patient will necessarily perish, by peritonitis, or by areolar infiltration and sloughing, according to the site of the urinous escape. In the third form—that occurring by unrelieved retention—there is but little hope ; yet there is some room for treatment. During violent effort to overcome the obstacle to expulsion of urine, something is felt to yield, and relief is experienced and expressed ; yet—probably to the patient's surprise—no urine is seen to come by the penis. By and by, the sense of relief and comfort passes off ; burning heat is felt in the infiltrated part ; and the constitutional symptoms attendant on asthenic suppuration and gangrene, which must follow, declare themselves in their most formidable shape, rapidly becoming more and more typhoid, and soon ending in fatal collapse. Or, if the viscus have fortunately given way at its most anterior part, the local mischief may advance outwardly, and perhaps evacuation by the perineum may occur, with more or less relief. Treatment obviously consists in reaching the infiltrated part, if possible, by early, free, and dependent incision, and in maintaining the powers of the system, under the strong depressing agent so busily at work, by every means at our disposal. No case, in which an outward and efficient opening has been afforded, is to be considered too desperate. Nourishment and stimuli must be steadily administered. Unexpected and wonderful recoveries have rewarded perseverance.

Urethral Extravasation is more common, as a consequence of stricture. The urethra gives way, by ulceration, at some part of its course ; and the bladder remains entire. There may not be the same sensation of something having yielded during straining ; but there is, generally, the same temporary feeling of relief having been obtained. Soon, however, there is a painful undeceiving ; the infiltrated parts become hot, swollen, red, black, dead ; a urinous odour seems to exhale from the whole body, but more especially from the parts affected ; and the ordinary typhoid irritation of system becomes more and more developed—low and rapid pulse, black tongue and mouth, sunk anxious features, cold clammy skin, hiccough, muttering, delirium.

The site and amount of local mischief depend on the part of the urethra which has given way. Not unfrequently, it is behind the bulb ; and the urine, restrained, at least for a time, by the deep fascia, burrows deeply. In such a case, the local signs may be obscure ; the scrotum being uninvolved, and the perineal swelling and discoloration at first in-

distinct. Should the glans penis be found swoln, hard, and blackening, it is a sign of the corpus spongiosum being infiltrated, and an omen of most sinister import. In such cases, an early and free incision, in the centre of the perineum, affords the only chance of relief and safety—the knife being pushed determinedly down, so as not merely to expose the surface of the infiltrated parts, but also to lay bare the source of extravasation.

When the giving way has occurred at a point anterior to the deep fascia, the case is more plain and less hazardous. The scrotum, and the integument of the penis, and the lower part of the abdominal parietes—not always the perineum—sometimes the inside of the thighs, become rapidly swoln, and of a dark red hue; then the integument blackens, crepitates, and sloughs; and, as the sloughs separate, urine and foetid sanies flow away. Long before this open state, however, the olfactory organs alone are sufficient for diagnosis. In this case, the incisions do not require to extend so deeply, but are more numerous and extensive; leaving no part of the infiltrated textures without a free outward opening. Poultice and fomentation follow the knife; usually with active support of the system. In a day or two the poultice is superseded by water-dressing; and this again is medicated by the chlorurets. Immediate hazard having been got over, and the parts having passed from excitement, means are taken to overcome the cause of the accident, and to restore the urethra to its normal condition. In the great majority of cases, a tight stricture is found anterior to the site of ulceration.

But urinous irruption does not always take place directly from the urethra; urinous abscess may have formed, as the first result of the stricture; and then, the parietes of this abscess having yielded, extravasation takes place outwardly. The consequences and treatment are the same as in the direct and ordinary variety.

Injuries of the Bladder.

This viscus may suffer in various ways, by the hand of the surgeon. In lithotomy it may be unnecessarily cut, or bruised and torn by the forceps or scoop. In lithotripsy, it may be pinched, bruised, or torn, by a rash and inexperienced operator. By the catheter, too, it may sustain hurt. The risks are hemorrhage and inflammatory change; to be obviated by the means already considered.

Not unfrequently, the bladder suffers by accident. The pelvis is broken; and a spiculum of bone, projecting inwards, is liable to penetrate the viscus, more especially if it happen to be distended with urine. Urinary infiltration can scarcely fail to occur; and probably to such an extent as to prove rapidly fatal. Or laceration may take place, in consequence of a blow or bruise; and it is well to remember, that this result may follow an application of violence apparently by no means great, if the bladder happen to be at the time full of urine. Blows, kicks, falls, have often proved thus fatal; and in the female it has occurred, from merely the superincumbent weight of another person. Ordinarily, however, the force applied is considerable. And unfortunately, the portion of the viscus which is most apt to give way is where it is covered by

peritoneum, near its fundus ; the outer coat, less extensile than the rest, is most apt to tear ; and, besides, the force is likely to jam this part of the bladder on the promontory of the sacrum. There is great pain in the region ; only a small quantity of urine comes by the urethra, and that is more or less mixed with blood ; no tumour of distended bladder can be felt by the rectum or vagina ; the catheter draws off but little fluid, and that is bloody ; by and by the ordinary signs of urinary infiltration are declared.

If the tear has been extra-peritoneal, on the anterior aspect of the bladder, there is hope in the treatment. The urine may, in its infiltration, approach the surface in the hypogastric region in a somewhat limited way ; timeous and free incision of the abdominal parietes may evacuate it, with sloughed areolar tissue ; and the patient may be saved—even with complete return of the urine to its natural channel.*

When the injury affects that part of the bladder invested by peritonum, the urine passes at once into the peritoneal cavity ; and escape from death is hardly to be looked for. Still there is room for treatment. The catheter is introduced ; no water will probably come, unless there has been penetration through the aperture in the bladder ; but the instrument should be retained, with its point just within the neck of the bladder, so as to afford an outlet to what may be afterwards secreted. Should the patient survive for a day or two, it is possible—as dissection has shewn—that by inflammatory agglutination of the abdominal contents, the general cavity of the abdominal peritoneum may be shut off from that of the pelvis ; the latter becoming coated with lymph, like an abscess, and the urine confined there. Under such circumstances it has been proposed to tap this cavity from the rectum, by means of the long and curved trocar.† Nature's effort to remedy the laceration is by contraction of the viscus, and outward protrusion of the mucous coat into the wound.

In the parturient female the distended bladder is apt to suffer. By instruments in extraction of the foetus, it may be torn ; by long-continued pressure of the head of an impacted foetus, it may be induced to slough or ulcerate ; and vesico-vaginal fistula is the result—provided the patient recover.

Tumours of the Bladder.

Fortunately this is a rare affection. The interior of the viscus, however, is occasionally the seat of tumours ; and these are of two kinds. Simple mucous polypi may form there, in considerable numbers ; simulating the ordinary symptoms of stone. The sound finds no calculus, but may be felt impinging on a soft and movable substance, obviously extraneous to the bladder's coat. It has been proposed to deal with this by means of the lithontriptor ; but the prospect of success does not seem very inviting.

Malignant tumours may form ; medullary ; growing from the coats of the viscus—usually near its neck, in apparent connection with the prostate—and occupying the cavity to a greater or less extent. Micturition is frequent and painful ; and the pain is greatest immediately

* SYME, Contributions to Surgery, p. 332.

† Lancet, No. 1386, p. 352.

after the effort ; the urine is bloody and fœtid, and often contains flaky substances, or masses of the disorganized tumour ; by impaction of these, occasional retention may occur ; dull weight is felt in the loins ; and the pain of micturition is much more pelvic, and more extensive there, than in the case of stone ; also the sound, on encountering the foreign body, imparts quite a different sensation. There is no remedy for this disease. We can only hope to palliate, by opiates, and the recumbent posture. Sometimes the tumour, expanding, may cause retention which is not capable of being relieved by the catheter ; and, in such circumstances, we are called upon to protract existence, by puncturing the bladder, above the pubes.

Cancerous disease may extend from the rectum to the bladder, involving all in one large and loathsome sore. Malignant tumours also form between the two viscera, as formerly stated. There is for such cases no cure.

Displacement of the Bladder.

It has been already stated that sometimes, though rarely, the bladder is protruded, so as to constitute the contents of a hernial tumour. And displacements, too, of this organ, by pelvic abscess and tumours, are alluded to elsewhere.

Miserable cases are not very unfrequent, in which the anterior half of the bladder is congenitally defective, as well as the corresponding part of the abdominal walls ; the mucous surface of the viscus becoming consequently protruded to constitute a red moist swelling, from which the ureters may be seen throwing out their fluid.* These admit of mere palliation, by wearing mechanical contrivances adapted for protection and comfort. If the patient live to old age, the mucous coat is apt to become covered with vegetations, which, assuming malignancy, may fungate and bleed, and prove fatal.

It has also happened, in the female, that the bladder has been inverted and protruded through the urethra, forming a vascular-looking tumour between the labia.† Were this removed, under careless diagnosis, by knife or ligature, the most serious consequences must ensue. The true nature of the case may be ascertained by discovering the orifices of the ureters, and finding the whole tumour to be reducible within the pelvis. Sometimes it is irreducible.

* HANDYSIDE, Edin. Medical and Surgical Journal.

† CROSSE, Trans. of Provincial Med. and Surg. Assoc. vol. ii. 1846 ; and Brit. and For. Rev., Oct. 1846, p. 319.

CHAPTER LIX.

AFFECTIONS OF THE PROSTATE.

Prostatitis.

THE prostate is liable to be affected by an acute inflammatory process, during the progress of virulent gonorrhœa. And this may also be excited by direct injury of the part—as by a blow on the perineum, or rash use of instruments introduced by the urethra ; by excessive venereal indulgence ; by imprudent exposure to cold and wet ; by sympathetic influence from affections of the rectum ; by the internal use of cantharides, or other irritants. Heat and pain are complained of in the perineum, near the anus, and there is tenderness on pressure there ; water is made frequently, and with pain ; and pain is greatest as the accelerator muscles exert themselves to expel the last drops ; there is a sensation of weight in the rectum ; and that bowel is evacuated with both difficulty and pain ; the finger introduced into the bowel ascertains the prostate to be large, hot, and tender on pressure ; and an attempt to pass a catheter into the bladder is difficult and painful—the difficulty and pain occurring when the instrument's point has reached the prostatic region. Not improbably, the affection extends to the bladder, and then the ordinary symptoms of cystitis are added to those already described. Treatment is by rigid confinement to the recumbent posture, leeching of the perineum, hip-bath, fomentation, and opiate enemata or suppositories. Sometimes relief is obtained from large, warm, and emollient enemata, which may be supposed to act as a poultice applied directly to the part. Direct leeching has been proposed, by means of a tube, or speculum, introduced by the rectum ; but it is probable that the irritation attendant on the application will more than counterbalance the benefit obtained by such abstraction of blood.

Abscess of the Prostate.

When the above symptoms sustain sudden aggravation, with rigor, increase of swelling and tenderness in the perineum, greater difficulty of micturition, and greater swelling and tenderness on examination by the rectum, it may be presumed that matter is forming in the gland. Careful examination is made, in order to arrive at correct diagnosis ; and as soon as fluctuation can be discovered, however obscurely, a direct incision is made by the perineum, to procure outward evacuation. If

an artificial aperture be deferred, the abscess may open into the urethra—favouring the formation of a urinous abscess; or into the rectum, establishing a troublesome recto-vesical fistula; or outwardly by the perineum, after much injury has been done to the intervening tissues. Spontaneous evacuation into the urethra is indicated by copious purulent discharge from the penis. And then it is advisable to use a catheter, gently introduced, as often as may be necessary to empty the bladder—for some days—so as to prevent, if possible, untoward entrance of urine through the ulcerated part; or a soft elastic catheter may be passed and retained.

Chronic suppuration of the prostate has been observed, causing much distress, with discharge of muco-purulent urine. On examination by the rectum, a soft point has been felt in the gland; and, on pressing it, matter has escaped by the urethra. The plunge of a lancet or trocar, into the soft point, has given relief, and troublesome fistula has not followed.

Simple Enlargement of the Prostate.

Simple enlargement of the prostate is of two kinds; one the result of chronic prostatitis; the other hypertrophy, independent of the inflammatory process; the one not uncommon in the adult of middle age, the other peculiar to advanced years. The former variety is dependent on stricture, or gleet, or affection of the rectum, or injury of the perineum by habitual horse exercise; and disappears, usually, on removal of its cause. If not, recumbency is to be maintained, a few leeches are applied to the perineum, these are followed by smart counter-irritation, and, at the same time, internal use of the iodide of potassium may be of service. The bowels are kept gently open, by simple laxatives and enemata. In obstinate cases, an alterative course of mercury is expedient; and, under this, amendment is sometimes both rapid and satisfactory.

Hypertrophy of the gland is usually regarded as but one of the many signs of senile degeneracy in the frame. As the eyes grow dim, the trunk bends, the cartilages ossify, and the arteries change in their coats—so the prostate is supposed to grow large and hard. The enlargement may be uniform, the whole gland seeming to expand equally; displacing the urethra as well as compressing it and consequently interfering with its function in regard to the urine. Or the central portion may enlarge, with greater rapidity than the rest of the gland; rising like a mammillary process; projecting backwards into the bladder; but, ever and anon, liable to move forwards, and so to act as an occluding valve to the outlet of the cavity. In general, the lateral lobes enlarge unequally; and consequently a twist is given to the prostatic portion of the urethra, in the lateral as well as in the vertical direction. In some cases, the enlarged condition of the prostate is due to the formation within its structure of fibrous tumours exactly resembling those which occur in the uterus, and ranging in size from a pea up to a walnut, but rarely larger than a filbert.

The symptoms of this simple hypertrophy are—increasing slowness and difficulty in making water, uneasiness and difficulty in emptying the

rectum, with a sensation of weight in that bowel and in the perineum ; sometimes the fæces are passed flattened, as in stricture of the rectum. On introducing a catheter, some difficulty is likely to be met with in passing the region of the prostate ; and when a finger in the rectum is made to press upwards on the catheter, the enlarged prostate is plainly felt between. Without the use

of the catheter or bougie, tactile examination is never certain. As the tumour enlarges, calls to empty the bladder are more frequent, and the act is less perfectly accomplished ; as formerly stated, a portion of residuary water remains, cooped up behind the enlargement. The bladder sympathizes ; it may become irritable ; more frequently, a degree of chronic cystitis is excited. The urine changes, in consequence ; becoming dark-coloured, foetid, and full of mucus. The vesical aspect of the projection may ulcerate, giving rise to hæmaturia, purulent urine, and aggravation of all the distress. The difficulty in micturition increases ; and at last—some casualty acting as an exciting cause—retention occurs. Generally, this has not existed long, before the “surface water” comes to dribble away ; and, by the establishment of incontinence, the retention is partially relieved, as formerly stated. It may happen, however, that the obstruction is complete ; and by retention the patient may perish. Or, the whole urinary system having become involved in disease, death takes place by gradual exhaustion. In some cases pyæmia sets in, proving rapidly fatal, with the formation of multiple abscesses, situated in internal parts, in superficial tissues, or in the joints. In other instances the prostatic inflammatory irritation induces a rheumatic affection analagous to gonorrhœal rheumatism, attended by copious serous accumulation, both in and around one or more of the articulations. The knee and wrist joints are more commonly affected than any other.

Treatment is but palliative. We can scarcely hope to retard, much less to remove, the enlargement. Every excess and imprudence is avoided, in diet and exercise ; and the recumbent posture is maintained as much as possible. The bowels are regulated by enemata and simple

Fig. 336.

Fig. 337.

aperients. Opiates are given occasionally ; and acids, iron, buchu, etc., are exhibited, as the complication by chronic cystitis may seem to demand. To avert distension of the bladder, the catheter is used as often as may seem necessary. Excision of the gland has been talked of ; but scarcely in sober earnest.

Fig. 336. The ordinary catheter ; of half size.

Fig. 337. The prostatic catheter ; of half size.

When retention has occurred, the catheter requires a peculiarity of management. As already stated, the urethra is considerably elongated ; and the catheter must be of proportional length. The prostatic portion of the urethra almost invariably has a bend given to it, antero-posteriorly—that is, the convexity is towards the rectum, the concavity towards the pubes ; and to suit this peculiarity of form, the instrument should have a large curve. Very frequently, the central enlargement or “third lobe,” as it is usually called—exists ; and, to surmount it, it is well to have at least one instrument in the prostatic set, whose point makes a sharper curve upon the general bend. It is introduced carefully ; and, to assist the point onwards, the handle is freely depressed after passing the triangular ligament ; while, at the same time, the point is elevated by means of the finger in the rectum. If the silver catheter, thus made and managed, refuse to enter, one of elastic gum may be tried ; bent to the proper shape, and introduced with the stilet. On reaching the prostatic obstruction, the stilet is gently and partially withdrawn, while the catheter is pushed steadily on, and the consequent elevation of the point may perhaps lead it over the obstruction. Or, the stilet being held steady, the tube is passed on, and the same effect is produced—the catheter’s point curving round that of the stilet, as it were.

There is another peculiarity. As the prostate enlarges, not only is the prostatic portion of the urethra unusually extended and curved ; it is also very considerably enlarged, by dilatation of the prostatic sinuses on each side of the verumontanum.* In retention, this dilatation is usually full of urine ; in fact, it may be considered as a small accessory bladder in front of the real one. On the catheter reaching it, a spoonful or two of urine may be discharged, and the surgeon may in consequence be led to suppose that he has reached and emptied the bladder, and that the remaining swelling consists of abscess ; the plunge of a trocar may follow ; or the patient may be left to his fate, unrelieved. But by invariably using the long catheter, in such cases, and never resting satisfied until this instrument is passed *tenus capulo*—unless, indeed, water flow freely, without such extreme insertion—the surgeon is safe from all such serious error.

Perhaps the prostatic obstruction proves insurmountable. Then the bladder must be relieved at all hazards ; and one or other of the following methods may be adopted :—The catheter may be forced through the obstruction ; guided in a good direction by the finger in the rectum. Or a trocar and canula may be used, instead of the catheter. Or the bladder may be punctured above the pubes. The operation by the rectum is obviously unsuitable.

Of these proceedings, perforation of the prostatic obstruction is the most advisable, by means of a suitable trocar and canula ; the latter of the same length and calibre as a full-sized prostatic catheter, but considerably less curved. It is passed carefully on to the obstruction, with its trocar withdrawn, and with its extremity temporarily occupied with a bulbous wire ; and, when satisfied by the finger in the rectum, that the instrument is duly directed towards the bladder, the bulbous wire is removed, the trocar is inserted and protruded, and the whole is pushed

* Deschamps, *Traité de la Taille*, tom. i. p. 222.

on. The trocar is then wholly withdrawn ; and the canula is retained for some days. In most cases, however, where it is deemed necessary to force the prostate, no difficulty will be experienced in carrying the common prostatic catheter onwards through the softened tissue of the enlarged gland. When the retention has been of long duration, and there is reason to believe that the kidneys are organically diseased, the urine is to be withdrawn gradually, for the reasons formerly adduced.

Malignant Disease of the Prostate.

The gland is sometimes, though rarely, the seat of scirrhus. More frequently it is affected by medullary formation, which enlarges rapidly, ulcerates, bleeds, and follows the usual course of such tumours. The disease is not peculiar to the aged. It may occur in children, as medullary tumours in other sites so frequently do. The symptoms are similar to those of mere ordinary enlargement, with the addition of those of tumours in the bladder, as well as of those which attend and characterize all malignant formations. The disease is incurable. By opiates, the catheter, enemata, and rest, we may hope to palliate and protract.

CHAPTER LX.

VENEREAL DISEASES.

THE history of the venereal disease is involved in some obscurity. However, it seems extremely probable—if not, indeed, quite certain—that affections of the genital organs, dependent on licentious venereal intercourse, have existed from the earliest ages; that they have prevailed in various degrees of frequency and intensity, at different times and places; that they were not directly imported from America to Europe, by Columbus' followers, in the end of the fifteenth century; but that, between the years 1493 and 1495—at the time of the siege of Naples—they experienced an aggravation in Europe, and consequently attracted much more prominently the attention of the profession.

They are usually spoken of under the general term of “the Venereal Disease;” and this again is divided into Gonorrhœa, Chancres, and Syphilis; all the result of the application of a simple or specific source of irritation, engendered by illicit intercourse—or at least communicated thereby; the first an inflammatory affection of the urethra; the second consisting of sores, some of which constitute a merely local disease, implicating nothing farther than the first gland in the nearest lymphatic chain; the last a contamination of the whole system, preceded by the formation of an ulcer on some part of the penis, or other portion of the body. By some, it is still maintained that the poisons are the same; that what produces gonorrhœa is capable of exciting chancres and syphilis, and *vicé versâ*. The weight of authority, however, preponderates largely in favour of an opposite opinion; viz., that gonorrhœa is due to no specific or constant cause—any irritant, chemical, vital, or animal, being capable of producing it;—that the soft chancre is a painful, destructive, but only local affection; and that syphilis is due to a peculiar specific virus by which alone can the disease be propagated.

Gonorrhœa.

An acute inflammatory process seizes on the lining membrane of the anterior part of the urethra; mostly caused by the application of gonorrhœal matter, from a second party; and this application usually made during sexual intercourse. There is usually an interval of uncertain extent between the date of exposure to the source of contagion and the appearance of the purulent discharge, which may show itself within not many hours after connection, or not till after many days have elapsed. About the fifth day may be taken as the average period of accession. Heat and itching are felt in the glans, which seems fuller and more deeply coloured than usual; the urothral orifice is uneasy, red,

and swoln ; urine is passed in a small stream, sometimes forked, and with increasing heat and smarting ; the orifice of the urethra shows an increased secretion of clear watery mucus ; then it becomes dry, more red and swoln, and painful ; the stream of urine is more diminished, and the pain which accompanies it is intense ; then discharge returns—no longer limpid, but turbid and puriform—becoming more and more profuse, and ultimately seeming to consist of true pus ; sometimes of an orange tint, more commonly of a greenish colour. If the disease prove intense, there may be a considerable admixture of blood. Sometimes smart fever affects the system ; sometimes there is but little constitutional disturbance. The thighs, loins, and testicles, sympathize in a dull aching sensation.

Such are the ordinary symptoms at the onset of the disease. But, in the course of its progress, serious additions may be made. 1. *Chordee may occur* ; that is, abnormal erection may take place ; the penis becoming bent like a bow—forming an arc of which the urethra is the chord—the convexity on the dorsal aspect—probably due to the inflammatory change which has taken place in the corpus spongiosum, preventing uniform expansion of its erectile texture. In some cases the corpus cavernosum upon one side is affected, then the deformity is lateral. Such erection is intensely painful, and tends to aggravate the disease ; it is also liable to induce profuse hemorrhage, probably by laceration of the mucous membrane, especially where forcible means have been employed to break the cord which the patient imagines ties the penis in its distorted position. The tendency to chordee is greatest during sleep ; while the patient is warm in bed, and perhaps excited by voluptuous dreams. Sometimes, its proximate cause would seem to be other than inflammatory structural change ; normal and abnormal erections alternating with each other. 2. *The glans may become excoriated*, furnishing a profuse discharge ; establishing what is termed spurious gonorrhœa. 3. *The prepuce may become œdematous* ; inducing the condition of (acquired) Phymosis, when the swoln prepuce maintains its ordinary relation to the glans ; causing Paraphymosis, when it is reflected behind the glans, and allowed to remain there. The former state aggravates the disease, by retaining discharge, and increasing the tendency to affection of the glans ; the latter leads to strangulation of the glans, and consequently to intense exacerbation there. 4. *The lymphatics may suffer* ; becoming painful, red, and swoln, on the dorsum of the penis ; or, without such indication, inflammatory enlargement may take place in the inguinal glands, constituting what is termed Sympathetic Bubo. 5. *Abscess may form in the penis* ; on the dorsum ; or beneath, opposite to the site of the lacuna magna. The latter is the more frequent site. A main residence of the inflammatory process—which, in the first instance, does not extend beyond two inches from the orifice—seems to be in this lacuna ; which swells and becomes hard ; filled with accumulated secretion internally, and externally invested by plastic formation. In this an exterior inflammatory process may occur, causing abscess of greater or less extent. 6. *Or abscess forms in the perineum*, at a distance from the original site of the disease—a less frequent complication ; in some cases in connection with Cowper's glands, either on one or both sides ; threatening retention

of urine by compression of the urethra, and urinous abscess by opening internally. 7. Or *prostatitis ensues*; sometimes by continuous extension of the inflammatory process along the membrane; more frequently, perhaps, by metastasis. And in severe cases—either originally and innately so, or become urgent in consequence of either mal-practice, or imprudence on the part of the patient—abscess may form in the prostate; usually superficial, as regards the urethra; temporarily causing retention of urine; early emptying itself internally, and rendering urinous abscess not improbable. 8. Or, the inflammatory process extends still further, and more untowardly—either by continuity, or by metastasis, and *acute cystitis results*; aggravating all the local symptoms, and by urgent disorder of the system bringing even life into peril. From the bladder—with or without abscess of that organ—inflammatory access has extended to the peritoneum, and proved fatal. 9. *Sub-acute rheumatism may supervene*; the joints of the limbs becoming painful and swoln, and the system suffering under inflammatory fever. The knee, ankle, and wrist joints are those most frequently and prominently involved. The supervention sometimes takes place during the acute stage, sometimes during the decline; occasionally the rheumatic symptoms are coeval with recrudescence of the gonorrhoea. Or gouty symptoms may be excited, in those of the better ranks, and of advanced years. 10. Very often, in protracted cases, epididymitis is set up; the inflammatory process seeming to creep along from the posterior part of the urethra to the vas deferens, and thence extending to the epididymis. The testis rarely becomes affected, the globus major being the site most commonly and decidedly affected. During the acute stage of such epididymitis, urethral discharge diminishes, and may wholly disappear; not necessarily proving a metastasis, but explicable quite on the principle of relief by counter-irritation. As the affection of the epididymis declines, discharge usually reappears.

Orchitis may be caused at any period of the case, by a blow on the part, by imprudence in exercise, or from the unseasonable use of irritating injections. The last named is, however, a rare cause of this complication. The long delayed cure and commensurate extension of the inflammatory process to the prostatic part of the urethra may be said, in almost all cases, to be the determining cause. If spontaneous in its accession, it usually occurs in the chronic stage; usually about five or six weeks after the first appearance of discharge.

Gonorrhoea is one of those affections which are capable of self-cure. The intensity of the symptoms gradually subsides; the complications which may have occurred are recovered from; and the discharge becomes less copious, and somewhat restored to the mucous character. This state is termed a *Gleet*—embers of the previous burning. There is little or no pain, swelling, or redness; thin discharge is the prominent symptom; with, perhaps, some trouble in micturition. In a patient who has suffered from previous attacks of urethritis, a greater or less degree of contraction in the urethra probably exists; but, in primary attacks, the gleet, unless of very long standing, need not be suspected of such complication. In any case it is not to be considered that the gonorrhoea has finally ceased—becoming merged in an affection of a different name and kind; for, from but a slight cause—as unusual exercise, imprudence in

diet, or such like—reaccession of the inflammatory process may take place ; and the gonorrhœa may be revived in even more than its pristine severity.

The *Treatment* of gonorrhœa varies, according to the stage of advancement. At the first onset, in imitation of the analogous affection, purulent ophthalmia, what is termed the ectrotic or abortive treatment may be attempted ; while the inflammatory process is still nascent, and suppuration has not yet occurred. The nitrate of silver is used, as in similar affections of the surface, with the view of procuring rapid resolution. It is applied, in the form of strong solution, to the affected part of the mucous membrane—carefully, by means of a vulcanite syringe—so as to act upon the anterior two inches of the canal. Some prefer the form of ointment,* or the solid caustic may be applied by a porte-caustique for the purpose. However applied, the operation should never be intrusted to the patient ; it must be performed by the surgeon. The patient should pass water, and the application is made while he lies recumbent. The urethra is compressed by the finger and thumb at the root of the penis, either by the patient, or by means of an india-rubber ring and pad of lint, or by the jugum penis. The bulbous nozzle of the syringe is introduced within the canal ; and, compressing the lips of the urethra around the narrow neck of the instrument, the surgeon presses down the piston of the syringe until he feels that the canal is distended with fluid. The syringe is then slipped out, while the fluid is retained by continued compression of the glans penis above and below, for three or four minutes, after which the injection is allowed to escape. A coagulated film is produced, which, adhering, protects the villous surface beneath during the passing of urine ; besides, the purely antiphlogistic effect of the remedy may be obtained here, as in erythema ; and, not improbably, a third beneficial indication may be fulfilled—the virus may be chemically acted on and neutralised. Such injection or application is made once or twice—at an interval of twelve or twenty-four hours ; and strict rest, with antiphlogistic regimen, is observed. Some employ the nitrate of silver in another way, for ectrosis ; using a weak solution—say two grains to eight ounces of water—and injecting this once every four hours, for ten or twelve times. We would put more faith in the concentrated and less frequent form of application. This is somewhat painful, and creates a desire to micturite which should be resisted for two hours at least, an opiate suppository or injection being employed to allay the irritation if required. The first time the patient passes water, a few flocculent flakes usually come away, and a sense of burning uneasiness is experienced. For a few hours a copious sero-mucous discharge may escape, or suppuration may be rapidly established. In either case, the irritation and discharge cease within a few days, with the use of simple diluents and a restricted diet. The affection may thus either be arrested altogether, or hurried on to suppuration ; in either case resolution may follow, and the disease be cut short in its outset. Obviously, however, such treatment is applicable only to the very earliest stage—which is seldom brought under the cognizance of the surgeon ; in irri-

* $\frac{3i}{\text{to}}$ to $\frac{3i}{\text{of}}$ of lard. The strength of the injection may vary from ten or fifteen to thirty grains of the salt in an ounce of distilled water.

table habits it is not likely to succeed ; and under even the most favourable circumstances, there is always a risk of failure, with consequent aggravation of the original disease. Indeed in some cases where the whole spongy part of the urethra has been injected in this way, extensive perineal abscess has followed, ending in a fatal issue.

Failing the ectrotic attempt—or, no opportunity having occurred for its practice—the acute or inflammatory stage is met by ordinary antiphlogistic means. And it is well to remember, in reference to this, that a first attack of gonorrhœa is generally most severe. Rest is enjoined ; but, for obvious reasons, this all-important indication is but seldom fulfilled—and hence one cause of this affection often proving tedious and troublesome in its cure. Diet is low ; the part is fomented, and by a handkerchief or bandage it is suspended ; antimony is given in nauseating doses, or may be advantageously used at the very outset as an emetic ; the bowels are gently moved ; but drastic purging does harm, by irritating the rectum, and involving the urethra in sympathy ; leeches may be necessary, and should be applied to the perineum or groins ; and, if uneasy feelings pervade the hips, loins, and thighs, the hip-bath will be found useful. To mitigate the ardor urinæ, bland fluids are drunk abundantly ; as linseed tea, a solution of mucilage, etc. To render the urine less acrid, saline draughts are useful ; as, a scruple of bicarbonate of soda, with a drachm of Rochelle salt, dissolved in tepid water, and then mixed with soda water ; taken three or four times daily. Bland enemata are useful, in regulating the bowels ; and, in the case of a sympathizing prostate, they are of service as a fomentation or poultice to that part. The antimony is of use, not only as antiphlogistic, but also as antaphrodisiac ; and this latter indication is to be assisted by suitable moral treatment on the part of the patient. Camphor, too, and lupulin, are useful in the same way. Should painful erections occur, opiates are given—especially useful in the form of suppository or enema at bed time ; a pill of morphia, or of hyoscyamus and camphor, is sometimes found to be more suitable ; repeated frequently as circumstances may demand. In other cases belladonna ointment applied to the part, or atropine administered internally, seems to allay irritation better than any other sedative. The patient should lie cool at night, with few bed-clothes, upon a hard mattress. Sometimes full doses of colchicum are of service, in relieving chordee—especially in those cases which possess the rheumatic complication. Leeching of the affected part itself is not advisable ; the bites are likely to cause swelling, partly by ecchymosis, partly by œdema ; and such swelling tends to complication by phymosis or paraphymosis ; besides, the wounds are liable to be inoculated by the virus of chancre if present, and troublesome sores may be the consequence. To prevent the patient turning in sleep upon the back, which predisposes to the occurrence of erections, a towel may be tied round the hips, with the knot fastened behind. A bladder or caoutchouc bag filled with morsels of ice, and laid over the pubes, will also prove of great service when other means of checking painful erection fail in their effect.

In this acute stage, ectrotic injection is not to be thought of. We would not seek for sudden suppression of discharge, were this in our

power. If it do occur, it may be regarded as an untoward event ; sure to be followed either by aggravation of the original disorder, or by implication of the prostate, bladder, or testicle, in the inflammatory process. Strong injection, therefore, is not only not suitable but dangerous. No doubt, it may temporarily arrest the discharge, but only because such exacerbation of the inflammatory process has taken place as checks all secretion ; pain, swelling, and redness are greater than before ; and discharge soon reappears in increased quantity.

The inflammatory crisis having passed over, the sternness of the antiphlogistic treatment is gradually departed from. And certain remedies are given, which by experience are found to exert a specific influence on the urethral mucous surface ; copaiba and cubebs ; the former the more suitable at first ; given in cautious doses, lest a deleterious amount of stimulus be imparted to the membrane. These remedies act on the part ; as is shown by experiment. If a patient with fistula in perineo have contracted gonorrhoea, and if the whole urine be permitted to pass through the fistula, no benefit will accrue from any dosing with cubebs or copaiba. But when, by shutting up the abnormal aperture, temporarily, the urine is made to pass over the whole urethra, amendment is at once observed. The same effect will also be attained by injecting the anterior part of the canal with the urine passed by the fistula.

As the case becomes chronic, antiphlogistics are gradually abandoned. And, for the state of congestion which remains in the membrane, the direct application of gentle stimuli is found useful. Pressure may be applied, by a compress over the corpus spongiosum ; but this is found irksome and difficult of management. The method of injection is preferable. A vulcanite or glass syringe with a bulbous point, and long narrow nozzle, is employed ; by means of which—inserted fully into the urethra—application of the injected fluid may be made accurately to the whole diseased surface. Backward extension to the bladder need not be apprehended, as the injection, however forcibly employed, cannot penetrate further than the bulb. The fluid injected is at first weak ; and its strength is gradually increased, according to circumstances. In nothing is there more room for variety. Some use an infusion of green tea, or other vegetable astringent. Sulphate of zinc is perhaps most commonly employed ; or the acetate of zinc ; or sulphate of copper ; or the salts of iron ; or the nitrate of silver ; or alum ; or the chloride of zinc ; or strychnine. A favourite injection is the acetate of zinc, with a proportion of opium. By some, the presence of some powder in a state of fine division, and suspended in a mild mucilaginous or weak astringent and opiate solution, is considered preferable ; affording, as it is supposed to do, a coating to the congested and tender surface, and thus keeping the irritated parts from being in actual contact. Acetate of lead and sulphate of zinc mixed together in an opiate solution is the most commonly employed, and is, on the whole, the most serviceable. Bismuth, oxide of zinc, oxide of silver, calamine powder, or carbonate of lead, may be similarly employed, suspended in mucilage, or glycerine and water. Urine is passed before injecting, so that the fluid may act directly upon the membrane ; and with the patient recumbent, the injection should be managed, by compressing the orifice of the urethra.

around the nozzle of the syringe, so as to distend the canal, and thus act upon the mucous follicles and crypts. On withdrawing the syringe, the point of the penis, still compressed, is held erect for some time, so as to keep the fluid in contact with the affected part. The operation may be repeated three or four times in the day ; or, when the injection used is weak, still more frequently ; but should over-excitement or a sense of prostatic irritation ensue, the injection must be wholly discontinued for a time ; and when resumed, it must be employed very cautiously. As already stated, its strength is gradually increased ; and if it seem to have lost its influence, it is better to change to a different kind, than to increase the first to a strength at all formidable. In fact, the principle of stimulation is conducted as in the use of lotions to a weak sore on the surface of the body. In obstinate cases, benefit may be derived from nitrate of silver rubbed on the perineum, so as to act as a smart counter-irritant. By some, especially army surgeons, blistering one or both groins, with the administration of diluents internally, while the patient is confined to bed upon a spare diet, has been found eminently efficacious.

In the truly chronic stage, large doses of cubebs (ʒi.) may be given with advantage ; regard always being had to the kidneys, lest over-stimulation occur there. And sometimes rapid amendment may be obtained by cubebs combined with copaiba and alum and rhatany, in the form of paste, given in wafer paper—an admirable remedy for the chronic cases, but too stimulant for the early stage, when attended by acute symptoms. These internal remedies may be employed along with injection. Or they may be alternated. But in no case should injection be long and continuously persevered with ; otherwise a discharge, due to the irritation created by the stimulant, may be maintained, keeping up a state of congestion in the membrane, delaying the cure, and rendering the occurrence of stricture very probable. In such circumstances, the use of cold water as an injection, and the administration of iron tonics internally are advisable.

In some very tedious and obstinate cases, acute reaccession is to be desiderated ; and this can easily be induced by the employment of either the porte-caustique, or the syringe, to act upon the urethral mucous membrane, with the nitrate of silver. Or the iodide of iron, of the strength of a quarter of a grain to the ounce of water, will form a good injection. Tincture of aloes diluted with water, decoction of guaiacum, syrup of Tolu, or balsam of Peru, suspended in mucilage, have all enjoyed a reputation, as forming trustworthy injections in that most capricious and tedious disease.

Sometimes the affection is chronic from the first ; a slight local irritation furnishing the discharge. This is liable to occur in patients of sluggish temperament, who have had many attacks of the disease. In such cases, antiphlogistics are never suitable ; and the stimulant mode of treatment is adopted at once.

The casualties of the disease are met as they occur. Chordee, as we have seen, requires cool covering of the parts at night, a suitable moral treatment, and sedatives. The attack, when spasmodic, may be moderated by immersion of the organ in cold water. Hemorrhage from the urethra,

though alarming to the patient, often requires no treatment ; being regarded as a salutary occurrence, auxiliary in the cure, and frequently followed by a complete cessation of the discharge ; if excessive, it may be restrained by the application of cold, or by pressure, as already described. Œdema is relieved by fomentation and poultices. Bubo requires fomentation and rest ; and its first acuteness over, the external application of iodine, or a solution of the nitrate of silver, is likely to obtain resolution. Abscess threatening in the penis, or in the perineum, is opposed by increased and concentrated antiphlogistics ; if matter have formed, an incision cannot be made too early for evacuation. Affections of the prostate and bladder require their suitable treatment, already noticed. Small cold enemata, containing a moderate quantity of laudanum, are sometimes very useful. And it is well to avoid these attacks, by doing nothing heroically, in the way of injection, after the gonorrhœa is fairly established. With some, no doubt, strong injections are still in vogue, even at an advanced period of the case. But, in our opinion, they are warrantable only at the very first, and only in exceptional cases, as already stated ; and should consist only of nitrate of silver. Gout and rheumatism are met by their peculiar treatment. And, obviously, it is important to remove the tendency to uric deposit as speedily as possible ; otherwise the passing of this cannot fail to maintain, and probably increase, the urethral excitement.

Thus, according to the ordinary principles of surgery, would we treat gonorrhœa ; and with a good hope of success ; if the indications regarding regimen and rest be fully carried out—a difficulty in many cases, as already stated. But there is no disguising the fact, that not unfrequently the disease proves quite intractable ; as if determined to run its own course, regardless of the means employed—unchecked, almost unmitigated and unmodified. In such cases, some peculiarity of constitution will generally be discovered ; scrofula, gout, or extreme irritability of system. And for such difficulties, no general rules of treatment can be laid down. Each must be met by what seems most suitable under the circumstances ; always avoiding undue activity of practice ; and preferring rather that the disease should run its own course, than that by unfortunate interference more serious affections of the prostate, bladder, testicle, or general system, should be induced.* In general a tonic treatment is required ; specially the preparations of iron and quinine ; and with the latter *nux vomica* may sometimes be successfully combined.

Bougies are by some recommended ; but we would move them altogether from gonorrhœa to gleet. Their use in the former affection is extremely apt to over-stimulate, causing reaccession of the disease. In gleet, however, they are very serviceable, by obviating any tendency to contraction in the urethra, and removing the congested state of the lining membrane ; and sometimes by means of a bougie, the citrine or some other stimulant ointment may be beneficially applied to the anterior part of the membrane. In obstinate cases, with irritability of the pos-

* The length of time during which an obstinate gonorrhœa may persist is sometimes great ; but scarcely so extreme as that mentioned by one eminent modern authority, who gravely tells us of claps contracted at the peace of Amiens in 1800, being still running in 1840 !—*Lancet*, No. 1263, p. 510.

terior part of the canal, upon which an injection, employed as already described, cannot act, nitrate of silver may be applied—cautiously—by means of Lallemand's porte-caustique.

In some cases of obstinate gleet, the discharge seems to be kept up by chronic prostatitis, and to come from the follicles of the gland. Under such circumstances, Chian turpentine, in five-grain doses, often arrests the secretion ; seeming to have a special action on these parts.*

After discharge has ceased, and uneasy sensations have almost wholly disappeared, great care is still necessary on the part of the patient. Cure is not yet complete. A hearty meal, a debauch in wine, venereal indulgence, a long walk or ride, may reinduce the discharge and pain. Avoidance of all such re-exciting causes, therefore, must be scrupulously observed, until at least a week has elapsed.

As to the period when the possibility of communication by urethral discharge ceases, opinions differ. Probably the matter is most virulent when it is most copious, nearly resembling pus in its characters, and when the symptoms by which it is accompanied are most acute. But such questions are, as yet, not fully removed from uncertainty ; and it is well always to approach error on the safer side ; holding for practical purposes, that so long as there is any discharge, no matter how small in quantity, or gleet in character, there is at least a possibility of communicating infection by it.

Sometimes the eyes suffer by gonorrhœa ; and one of two affections may occur. *Gonorrhœal Ophthalmia* includes two distinct affections ; one the purulent Conjunctivitis ; the other an affection of the aqueous capsule, forming a part of, though possibly the only symptom of, gonorrhœal rheumatism. Gonorrhœal Conjunctivitis, as formerly noticed, is in all cases the result of direct contagion ; gonorrhœal matter having been applied either from a second party, or from the genital organs of the patient himself. It is rarely or never seen in women. The inflammatory process is rapid and intense ; and active measures are necessary, to prevent serious structural change. Gonorrhœal aquo-capsulitis, on the other hand, is a remote result of the irritation of the prostatic portion of the urethra ; the symptoms are usually mild in their character, and demand no severity of treatment. It most frequently occurs in those who suffer, or have suffered previously, from gonorrhœal rheumatism ; and is not unlikely to be associated, or to alternate with affections of the joints.

Secondary symptoms, of any kind, after urethritis, are rare. Sometimes, indeed, a febrile disturbance is followed by papular eruption ; this is due, however, in general, not to the gonorrhœa, but to the copaiba, which possesses this peculiar property in certain constitutions, just as shell-fish in some persons always induces nettle-rash. This eruption of *Lichen* or *nettle-rash* (urticaria) must not be mistaken for scarlatina on the one hand, or for syphilitic manifestations on the other. The effect of saline purgatives, the warm bath, and discontinuation of the copaiba, will at once enable the practitioner to form a diagnosis. When undoubted secondary syphilitic eruptions follow after gonorrhœa, three possibilities may account for this manifestation ; 1st, That the discharge from the

* Adams on Diseases of the Prostate, p. 35.

urethra was due to the existence of an indurated sore (masked chancre) within the canal; 2d, That an indurated chancre existed contemporaneously or antecedently with the gonorrhœa, either upon the genital organs or elsewhere; 3d, That the gonorrhœal discharge itself is merely the result of a secondary affection of the mucous membrane of the urethra. In all such cases, the site of the chronic glandular enlargement, characteristic of the syphilitic infection, will point to the probable site of the originating chancre.

Gonorrhœa Preputialis, sometimes termed *Spurious Gonorrhœa*, but more correctly *Balanitis*, or *Balano-posthitis*, denotes a condition of the preputial membrane and investment of the glans, similar to that of the urethral lining in gonorrhœa. The disease may be an accession to gonorrhœa; or it may occur independently of this, from the same cause. Or it may be altogether simple in its origin; resulting from accumulation of acrid secretion, or from retention of calculous matter, or from external injury. The part is red, swoln, partially abraded by superficial ulceration, and discharges a profuse puriform secretion. The prepuce is œdematous; and there is more or less trouble in micturition. Treatment is simple. An ectrotic result by nitrate of silver is almost always in our power. The glans, having been exposed, is pencilled lightly over by nitrate of silver in substance, or what is better, by a strong solution of it. Within four-and-twenty hours, the intensity of the inflammatory process, and the amount of secretion, will be found greatly diminished. And, very probably, another application will complete the cure. Of course, rest and antiphlogistic regimen are not neglected.

Warts are a frequent concomitant of the foregoing affection; or they may form independently of it. They are usually clustered round the corona glandis, and on the frænum. The best method of removing them is to take away the projecting portions by knife or scissors, and then to touch the stools with an escharotic; the nitrate of silver, firmly applied, may prove sufficiently powerful; or some one of the other suitable destructives may be used—as bichloride of mercury, dissolved in alcohol, ʒi. to ʒi. ; or equal parts of savine powder and burnt alum, or of desiccated sulphate of iron, dusted by means of a muslin bag or blow-pipe between each of the separate papillæ of the warty mass, and renewed as soon as the application becomes moistened by the secretion rendered from the surface—while the glacial acetic acid, which possesses a special solvent power over the albuminous tissues, is sometimes useful when the growths are scattered discretely, like millet seeds, over the parts. The hydrofluoric acid, however, if caustic is to be used, is more potent than any other. By some a strong infusion of tormentilla officinalis is commended. But removal by means of sharp-edged probe-pointed scissors is the most efficacious of all. The bleeding may be copious, but is easily checked by pressure, or by application of the saturated solution of the perchloride of iron.

By some a mild form of urethritis, attended with muco-purulent discharge, has been called *Gonorrhœa simplex*, *benigna*, or *spuria*. The sole distinction, however, which can be made out is, that the cause can be satisfactorily traced, and that it is not of the nature which is usually calculated to induce enthetic diseases.

Gonorrhœa in the Female.

The female suffers comparatively little from Gonorrhœa. For a few days only the acute symptoms persist ; and the chronic stage is attended with but little discomfort. The parts involved are the urethra, as in the male, the vulva and exterior of the vagina, and the os uteri ; the last-mentioned part frequently becoming affected by superficial ulceration. Occasionally the vulvo-vaginal glands (Bartholin), upon one or both sides, are implicated, by an extension of the inflammatory affection of the mucous membrane along their ducts. In such cases, acute suppuration of the gland, and the formation of an ovoid or pyriform abscess of the labium, characterize this complication. Such an abscess may open externally ; sometimes it undergoes a partial evacuation along the dilated duct ; occasionally it opens in both directions, forming a vulvo-vaginal fistula. The inflammatory extension is sometimes inwards, affecting the uterine cavity, the fallopian tubes, and even the ovaries. The uterine cervical cavity is in some cases alone implicated ; and then an increased and altered secretion from the follicles of Naboth, hanging jelly-like from the patulous os uteri, indicates this condition, when the parts are inspected by means of the speculum. Sometimes the inguinal glands enlarge sympathetically. The prominent symptoms are—discharge, painful micturition, pain and swelling of the vulva, particularly of the labia minora, œdema of the præputium clitoridis, uneasiness in sitting and walking ; at first, some constitutional disturbance ; often an aching in the back and loins. Treatment is simple. At the outset, an ectrotic result may be obtained ; the vulva and vagina being pencilled over by nitrate of silver, which may also be applied to the urethra by means of a porte-caustique, or in solution by means of a syringe. In executing the last-named proceeding, care must be taken to confine the action of the nitrate to the urethra, compressing that canal at the neck of the bladder against the symphysis pubis by a finger introduced into the vagina. Failing an opportunity for the employment of this, during the short acute stage, recumbency is enjoined, with antiphlogistic regimen ; the parts are diligently fomented ; warm water injections are thrown up the vagina by means of a Higginson's syringe with a long gum-elastic tube ; and oxide of zinc ointment, or a weak solution of acetate of lead and opium, is applied between the folds of the labia by means of lint. When the urethra is affected—and then only—copaiba may be advantageously administered, and demulcents given freely. Afterwards injections are to be used, of greater strength than in the male—the pelvis being elevated during and for some time after injection, so as to prevent premature escape of the fluid ; and a piece of lint, soaked in the stimulant solution, may be kept constantly applied between the folds of the vulva. Of these, oak-bark decoction and alum will usually be found most suitable ; and a detergent injection either of warm water alone, or containing borax or soft soap, may be employed in the intervals between the use of the astringents. If this is not done, a curdy albuminous substance is apt to collect in the passages, creating in process of time great irritation. When the affection proves tedious, cotton wadding, powdered with calamine, oxide of zinc, or mag-

nesia, may be introduced by means of a speculum so as to keep the tender and congested surfaces of the mucous membrane separate. When the source of the irritation seems localised in one part, an occasional application of the nitrate of silver pencilled over the surface will prove useful. When the discharge escapes from the uterus, nitrate of silver may be applied to its interior by means of the porte-caustique ; or a sponge-tent may be employed to dilate the cavity, and thus afford a free escape for matter collecting within. Ultimately, a tonic system of general treatment may be expedient.

Young girls are liable to suffer from a spurious gonorrhœa, caused by some intestinal, rectal, vesical, or general irritation ; and consisting of an excited and perhaps excoriated state of the vulva and orifice of the vagina, with discharge. It yields readily to removal of the cause, followed by the simplest local treatment. A knowledge of its nature and origin is obviously of much importance, in a medico-legal point of view.

The true gonorrhœa, unless when acute, is undistinguishable from Leucorrhœa, except by its history and accompaniments. It is well to recollect, however, that, except in gonorrhœa, vesical and urethral disorder, with glandular irritation in the groins, is comparatively uncommon.

Sores.

Herpetic eruptions, followed by sores of the penis, often occur on the integument of the body of the organ ; sometimes they form on the preputial lining, behind the glans. In the former site, the vesicles usually desiccate, leaving a red surface occupied by black or brown spots, which look as if burned by a red-hot iron ; in the latter the vesicles give way, leaving a number of irritable sores of a round form and yellowish surface, aggregated together upon an inflamed base ; sometimes, however, by coalescence the ulcers form one large, irregular, yellowish, irritable patch. This affection may be caused by the contact of acrid female secretions—not virulent ; or their accession may be altogether unconnected with sexual intercourse. It is discriminated by the character of the vesicles ; their plurality, circinate form, speedy formation—the intense burning pain by which they are preceded, accompanied, and sometimes even followed—the tendency in the patient to similar formations elsewhere, either previously or coincidently—the presence of more or less gastro-hepatic derangement—and the rapid healing of the sores in connexion with simple soothing means. Rest, cooling medicine, and the application either of water-dressing or of oxide of zinc ointment, constitute the necessary treatment. Having once occurred, it is liable to return from time to time.

Eczema may appear upon the glans or inner aspect of the prepuce, presenting a slightly tumid surface, with minute punctuate vesicles, which usually give way within the first two or three days, and leave an oozy, tender, excoriated, or fissured condition. Simple soothing dressing, or an alkaline lotion, usually suffices ; but the use of arsenic internally may sometimes be required to produce a permanent cure.

Simple Abrasion or Excoriation is known by its immediate appearance, by absence of the preliminary inflammatory process and pustular forma-

tion, by its superficial extent and irregularity of form, by the absence of true ulceration, by speedy assumption of the healing process, and by the absence of all enlargements in the chain of inguinal glands. It heals under ordinary simple means. It should be remembered, however, in considering the history of such abrasion of the genital organs, that all that constitutes the difference between an abrasion or excoriation and a chancre, is the possible presence or absence of the chancre-virus from contact with the abraded surface, whether during connection or afterwards.

Common non-specific sores are known by the history of their production, and by absence of the characteristics of the venereal ulcer. If any doubt exist, it is expedient to treat the sore, locally, as if it were really a chancre. Thus all risk of communication of the disease is averted. And, if it be considered of importance to arrive at certainty on the subject, the test by inoculation may be had recourse to. A portion of discharge from the sore is inserted, by the point of a lancet, on the antero-lateral region of the abdomen; if the virus of the soft chancre be present, specific results will occur as in the case of other experimental inoculations with matter taken from the soft chancre. And then, by freely rooting out the forming pustule and the sore by means of an escharotic, propagation of the disease is prevented. With the indurated chancre, the common non-specific ulcers of the genitals are not likely to be confounded; the characters of the former and the existence of specific glandular enlargement serving to render the diagnosis easy. Some secondary ulcerative affections of the balano-preputial mucous membrane, of the condylomatous or pustulo-crustaceous type, may, however, be mistaken for soft chancres; or, in consequence of the presence of a multi-glandular indurated enlargement of the inguinal lymphatics still existing, for an indurated or syphilitic sore. The non-auto-inoculability of the pus will serve to distinguish it from the soft form of chancre; while the presence of other eruptive affections of the condylomatous, squamous, or pustulo-crustaceous type, should serve to indicate that, although possibly situated upon the site of the originating indurated sore, it belongs to a more advanced period in the history of the disease.

Specific Venereal Diseases.

These include all the diseased states, local and constitutional, which are caused by the introduction of virus into the tissues of the body by inoculation of the secretion derived from sores, which usually form upon the genitals, and are propagated by a similar mode of communication. In some cases the virus, when introduced into the part, produces an inflammatory irritation, accompanied by the formation of either a pustule or an irritable sore, according to the nature of the solution of continuity in the scarf skin which has permitted its entrance. This inflammatory process always results in suppuration and more or less ulceration, sometimes even in sloughing; and the matter coming from such a sore is capable of reproducing a similar series of pathological phenomena in any part, or individual, if only certain requirements are fulfilled. These are: 1st, that a surface is provided from which the scarf

skin has been abraded by friction, by incision, by laceration, or by ulceration. 2*d*, That the secretion from the sore is non-putrescent; the mere appearance of the purulent fluid being unimportant, and the presence of its pus globules non-essential. The discharge from the sore is merely the vehicle in which the virus is contained. 3*d*, The sore must not be in a healing condition; its secretion then being simply healthy purulent fluid.

In other cases, again, a sore forms slowly and insidiously, with but little pain, and having little tendency to suppurate, ulcerate, or slough; and, instead of being limited in its results by the local ulceration, or by its effects upon the neighbouring lymphatic glands, radiates its influences throughout the whole system; declaring itself by eruptions upon the surface; and these constituting the *Secondary* or *Constitutional symptoms*. In some patients no further manifestations of the disease occur; in others, affections—of bone, skin, and mucous membrane—make their appearance at a still more remote date; and these are termed *Tertiary symptoms*.

The appearance presented by these venereal ulcers, primary sores, or chancres, as they are usually called, are of very different kinds. Modern investigation, however, has succeeded in arranging them under two heads: 1*st*, Those which are not; and 2*d*, Those which are followed by constitutional affections. Hence it has been inferred, that there are varieties in the originating virus—that there is in fact a plurality of poisons. At present, the question is still involved in some uncertainty. But for practical purposes, it is sufficient for us to know, that all venereal sores are not alike in their characters, progress, and results; that at least two different species exist, and can readily be discriminated; and that each of these requires totally distinct treatment.

But, in the first place, it is important to observe, that all sores of the penis are not venereal; and, further, that all sores of the penis, caused by impure sexual intercourse, are not necessarily the product of a specific virus. The penis is as liable as other parts to ordinary causes of the common inflammatory process; and common sores (herpetic, eczematous, etc.) may result. Again, it is liable to be excoriated during coition; and a sore may form in consequence, quite-unconnected with inoculation of any virus.

I.—*The Simple, Soft, Non-infecting Chancre—the Chancre without Syphilis, Chancroid.*

If previous excoriation, or other breach of surface exist, the sore may declare itself at once; the incipient inflammatory process becoming apparent almost immediately after connection; and this is the most frequent succession of events. Occasionally, however, the virus finds its way through entire skin or mucous membrane. And a day or two, consequently, may be occupied by a period of incubation.* Then the

* There seems good reason to suppose, that in general the virus begins to act from the very moment of its application; and that the examples of apparently protracted incubation depend, chiefly, on the circumstance of the poison having been temporarily intercepted, as it were, by a hair, mucus, a sebaceous follicle, a hardened portion of cuticle, or other obstruction.

inflammatory process, causing pustular formation and ulcer, advances, as already stated ; ulceration being generally established by the sixth or eighth day from the time of infection. The progress may be conveniently divided into *four* stages :—*First*, that of inflammatory accession and pustular formation. Redness forms, with itching and heat ; in the centre of the redness a papule rises, and vesication takes place ; the contents of the vesicle, at first serous and milky, become purulent—constituting a pustule ; this breaks, with or without scabbing, and discloses an acutely-inflamed ulcer beneath. The *second* period is that of ulceration ; occupying, like the first, from three to ten, or even more days. The advancing sore is usually of a circular or oval form, as if a portion of skin had been punched out ; of pale yellowish, or ash-gray, worm-eaten surface ; surrounded by a finely-serrated margin, and a bright, gradually diffused, inflammatory areola ; and furnishing an ill-digested gummy discharge, containing pus-globules and fragments of broken down tissue. This is the period of extension of the chancre ; and it is now that the most favourable opportunity exists for attempting the test by inoculation—if such be desired. During this period it is, too, that multiplication of the sore by spontaneous inoculation is so apt to occur, the virus being particularly irritating. Hence soft chancre is rarely single, usually multiple. Having arrived at a size which differs in each case, depending a good deal upon the texture in which the sore is situated, its position, and the care or neglect with which it is treated, the *third* period is reached, viz., of specific *status quo*. The sore becomes no larger, but it continues to render a virulent secretion. Gradually, however, the undermined, dusky, or violet-coloured margins become less elevated ; the surface begins to secrete a more healthy pus ; and large, flabby, weak granulations appear in the centre of the ulcerated surface ; while the margins become adherent to the parts beneath, and continuous with the granulating surface. The *fourth* stage, that of *reparation*, is now in progress ; and cicatrization is begun—usually taking from a fortnight to six weeks to become complete. During the period of extension, the destruction is usually more apparent than real, and rarely eats deeper than the tissue of the true skin ; sometimes, however, destroying it superficially to a very considerable extent, and thus creating unseemly puckering from cicatricial contraction. In most cases, when the sore is small, little or no trace of its existence is left after a few months have elapsed. It is very different, however, when the ulcer becomes phagedænic ; to which change it is peculiarly liable. In some of these cases, the destruction is very great—prepuce, glans, and even the limb of the penis melting away under its influence, and leaving behind great deformities.

The further signs by which this sore is distinguished, are : the absence of surrounding induration, its special tendency to phagedæna, and the frequency with which it involves the lymphatic gland, which lies nearest to the sore in the neighbouring chain, in a phlegmonous inflammatory process, terminating in suppuration, both within and around the affected gland. The pus of the former depot, being chancrous, infects the aperture of evacuation, and on inoculation affords specific results. While, however, the soft chancre possesses no true “induration” of the base, this may be very closely simulated in some examples of this

class by "hardness," due to the accompanying inflammatory change acting on the surrounding tissues ; and the effect of some caustics and metallic lotions is to give to the base of the soft chancre a feeling of hardness closely approaching to that of the Hunterian sore. Phagedæna, too, may occur in other sores upon the genitals besides the soft chancre, whether they are of a simple kind or truly "indurated." According to some authorities, the sores which, in the early period of their history, present phagedænic characters, and at a later period become indurated and followed by a well-marked syphilitic poisoning, are to be ascribed to a double infection, with the virus of both forms of chancre, the soft and the indurated. The characters of the soft are accordingly first manifested, accompanied by its accessory phagedæna ; then at a later period the indurated characters display themselves, and are followed by a train of well-marked and serious secondary and tertiary lesions—the mere fact that phagedæna has occurred indicating an originally debilitated state of system, and one predisposed to suffer severely from the syphilitic infection.

The ordinary site of the soft chancre is on the prepuce, and in the sulcus behind the corona glandis ; often it is by the side of the frænum ; occurring, in short, in the parts most susceptible of laceration, most exposed to contagion, and where the virus is most likely to nestle, overlooked.

All sores near the frænum are unfavourably situated. The second stage is of long duration, and ulceration is acute ; the sore continues to enlarge ; often it burrows beneath the frænum, causing perforation ; and reparation seldom advances, until the frænum has been wholly destroyed. In all such cases, therefore, it is well to abbreviate the process, by division of the frænum at once ; care being taken that troublesome hemorrhage do not ensue, from the small but active artery which generally shows itself at the time of incision.

There are three varieties of the soft chancre which deserve notice :—1. The *Diphtheritic* ; 2. The *Follicular* ; 3. The *Furunculoid*. The *Diphtheritic* presents usually a yellowish colour and a superficial aspect, as if but half the thickness of the true skin were involved, and as if the exposed surface were coated with a piece of wet chamois leather, set in an irregular cutaneous margin of a bright rosy hue. The *Follicular* is due to the lodgment of chancrous matter in the open mouth of a follicle. The crypt suppurates acutely, raising the surrounding cutaneous or mucous surface into an elevation about the size of a pea, in the centre of which a yellow aperture is observable. Such sores are slow of healing unless destroyed with caustic ; which, to act efficiently, must not only be made to touch the aperture, but to destroy the whole interior of the sac. The *Furunculoid* can easily be produced by artificial inoculation ; inserting the virus not only into the vascular layer of the true skin, but penetrating the cutaneous tissue, and lodging the matter in the areolar tissue beneath. An acute boil forms, the pus from which is chancrous. The edges of the boil become undermined, ulcerate, evert ; and sometimes the sore so produced attains to the size of half-a-crown before the period of arrest and cicatrization is attained.

In treatment, early application is of the greatest importance. For it is only by early treatment that we can be certain of success in the ectrotic attempt, so as to prevent lymphatic absorption and the occurrence of bubo. All practitioners of experience in such diseases are agreed that, at as early a period as possible, we should root out the disease; "punching it out," as it were; converting the poisoned ulcer into a simple sore; preserving the patient from the risk of bubo, from the occurrence of phagedæna, from extension and multiplication of the sore, and from communicating it to another person. For this purpose, a true escharotic is freely applied; the fuming nitric acid, the acid pernitrate of mercury, mono-hydrated sulphuric acid mixed with charcoal powder, saffron, or sulphate of zinc; or what is more certain, the potassa fusa or chloride of zinc—pointed, inserted accurately within the sore, and pressed there firmly, so as thoroughly to destroy not only its surface but its edges, and include an atmosphere of healthy tissue around—the fluid exudation being wiped up, as it threatens to overflow, by means of blotting-paper. When the action of the caustic has been deemed sufficient, the surface is dressed with dry lint, or charpie, so as to protect the adjacent or opposed parts. Water-dressing is afterwards applied, until the eschar separates. Should the discharge, in contact with the eschar, prove fœtid, the weak chlorinated lotion may be employed—while the slough separates. After it has come away, the surface is anxiously scanned. If it present the characters of a simple and healthy sore, water-dressing is continued; and as healing advances red lotion may be substituted. If, however, the tawny surface and angry appearance of a still virulent ulcer show themselves, the escharotic is reapplied. And such repetition is carried out, from time to time, until a satisfactory clearing has been obtained. When, however, destruction has been thorough at first, there should be no need for any repetition.

If healing once begun is delayed, and the granulations threaten exuberance, there is no better plan than to touch the elevated surface, every second day, with the nitrate of silver lightly; applying water-dressing intermediately. During the treatment, whatever the condition of the sore or stage of amendment, rest is of the greatest importance; and the organ should also be suspended by a handkerchief, bandage, or strip of adhesive plaster.

When the patient cannot bring himself to submit to the use of caustic, we have comparatively little control over the progress of the sore, or power to prevent the complication already mentioned. A weak astringent lotion frequently employed, so as to harden the surrounding cutaneous or mucous surfaces, to diminish the quantity of discharge, and to render it innocuous, with a careful attention to cleanliness, constitute the principal items of treatment. For this purpose, solutions of the sulphates of copper or zinc, of the strength of two grains to the ounce of water—or of chloride of zinc (gr. i. ad ʒi.)—will answer better than any other. When the sores exist under cover of a prepuce which cannot be retracted, so as to expose the surface for the purpose of cleansing away the discharge, and applying caustic, or lint soaked in an astringent lotion, to the surface, it may be necessary to slit up the prepuce and denude the glans; or we may gain our end by injecting the lotion within

the prepuce; lint being afterwards tucked in, by means of a probe, between the prepuce and glans, as far back as the balano-preputial sulcus. The former device should only be resorted to when the swelling is so great as to interfere with the vitality of the prepuce, or with micturition; as the cut surface, unless, indeed, it be carefully destroyed with caustic along with the sores, is sure to be converted into an extensive chancre.

Warts are not an unfrequent consequence of the irritation of cutaneo-mucous surfaces produced by the existence of soft chancres. They are subject to the same treatment, and are equally non-specific, as those which attend on gonorrhœa.

II.—*The Indurated, Hunterian, Infecting, Syphilitic, or True Chancre.*

This form of sore has only within a comparatively recent period been definitely distinguished from the soft chancre. Although in most cases possessing well-marked characters, these vary in degree, according to circumstances more or less appreciable. When, however, a well-marked example is examined, we find its characters consist in being a *superficial erosion*, situated upon an *indurated base*. The ulcer or sore has a regularly rounded, oval, or elongated form, according to the part upon which it exists; sometimes not larger than a millet seed, rarely attaining to the size of a shilling. In any circumstances the loss of substance is quite superficial, rarely implicating the whole thickness of the true skin. The surface, in its early or extension-period, usually presents a pearly grey aspect without granulations; at a later period, and when stationary, it has a dark red, tawny, or brownish tint—or glossy appearance, as if varnished; at other times, especially when about to heal, it shows a purely granular aspect. The general surface is usually cup-shaped, as if scooped out by means of a gouge. The edges sometimes, from the induration being more or less elevated, slope gently downwards and become continuous with the surface of the sore. They have usually a white, ring-like aspect, within which the sore is set, and which is easily observed when the tissues are compressed with the fingers or otherwise put on the stretch. There is scarcely any secretion from the surface of the sore; and what there is consists of serosity more or less gummy in its character—containing usually no pus globules, and nothing but a few epithelial scales. The induration of the base and margins of the ulcer constitutes its great characteristic; giving an almost cartilaginous consistence to the atmosphere of texture which surrounds and subtends its surface. This induration, according to the size of the sore, resembles in well-marked cases a millet seed, a split pea, a bean, or a nut, implanted in the textures of the affected part. Sometimes, however, the induration is not so well marked, but is only superficial; resembling rather a bit of parchment, and requiring skilled fingers to recognise its presence (induration “*en surface*,” or “*parcheminée*”). The difference is apparently due to the degree of development of the lymphatics in the part; being most perfect where the lymphatic system is most developed and its vessels most numerous—as for example upon the balano-preputial fold, or the prolabium of the lips. When this induration is greatly pronounced, the surface of the sore becomes

elevated above the surrounding parts, constituting one form of the *ulcus elevatum* of the older pathologists. On the mucous membrane of the vagina, the carunculae, the verge of the anus, the glans penis, and cervix uteri, the induration is but slightly developed; usually assuming the superficial form, and in most cases rapidly disappearing after the sore has healed. The dense cartilaginous form, on the other hand, is usually very persistent; remaining long after the cicatrization of the initial sore—sometimes even for so protracted a period as thirty years. When it has



Fig. 338.

disappeared, a brown stain or macula usually occupies its site; and when this by degrees fades away, an unnaturally white mark permanently indicates the situation. The indurated chancre is rarely multiple; there being in the same patient commonly but one sore; and when more exist they are all traceable to the same date, and are marked by a like progress. The degree of induration may, however, vary in each. The indurated sore is not surrounded by any inflammatory areola. There is,

however, another characteristic of it; and that is the certain presence of a multiple non-inflammatory glandular enlargement and induration occupying the neighbouring lymphatic chains.

The commencement of this form of disease is involved to a large extent in obscurity. That this should be the case need be no wonder, when we consider that, as a rule, the indurated chancre cannot be artificially inoculated into the textures of the individual suffering from it, or of another who either has, or has formerly suffered from, the syphilitic infection. Unlike the soft chancre, it seems to have a real period of incubation. The length of this has not yet, however, been satisfactorily determined; some assigning to it a few days, and others admitting so many as forty. More careful consideration tends to the conclusion that from ten days to a fortnight, or even three weeks, constitutes the common limits. In some cases a small crack, fissure, or abrasion is observed after suspicious connection; this heals and gives no further annoyance; but after the lapse of days or weeks, when all has been forgotten and the patient's anxiety set at rest, the fissure or abrasion is covered with a crust, and the texture in which it is situated becomes indurated and elevated in the form of a papule or tubercle. The variety in the extent of the induration seems to depend upon the size of the original solution of continuity; sometimes resembling a papule, sometimes a pea, at other times covering a surface as large as a shilling. In those last-mentioned cases, however, it will generally be found that the sore has extended its limits; its original surface having been much less. In extending, the induration precedes the ulceration, and always limits its progress. The tardily developed true indurations, which some writers have described, do not really occur. In cases where they have been supposed to have formed, the induration has existed from the commencement, and has only become more pronounced and visible by the persistence of the sore, and the delay which occurs in the commencement of the healing process.

The ulceration, which is always superficial, sometimes resembles an

Fig. 338. An indurated sore on a common site.—After ACTON.

eczematous peeling, sometimes a sloughing of the superficial dermal layers. Under all circumstances, it reaches its limits within a very few days. Some authors allege that the discharge is inoculable in the individual himself who suffers from it, or in others affected with constitutional syphilis, but only during the first few days of its existence; when, in fact, the sore is in its stage of progress. Others, again, assert that an indurated chancre at any period of its existence, if irritated so as to render a purulent discharge from its surface, is capable of affording specific results upon inoculation in syphilitic patients. In such circumstances, however, it is acknowledged that, in the base or margin of the sore so produced, no induration occurs. Such second-hand sore is merely a chancre with a soft base, and followed by no glandular enlargement or constitutional symptoms. This fact might, at first sight, be supposed to have given us the clue to the source of the common soft chancre; and, accordingly, some have assumed that it is merely a degeneration of the chancre with the indurated base. But unfortunately for such a theory, the chancre with the soft base occurring in a syphilitic subject may have two sources; either a simple soft chancre, or an indurated chancre. But the chancre, under such circumstances, which has been derived from the indurated sore, and which in its transmission to the syphilitic patient has lost its specific induration, at once develops its specific characteristic when communicated to a patient who has never had syphilis, and reappears as the true indurated chancre.

This sore, when of large size, with the induration, both basal and marginal, well-developed, heals slowly; as the dense cartilaginous hardness of the texture in which the sore is implanted prevents cicatricial contraction. And in such cases, when it does heal, the cicatricial pellicle is apt to give way from the most trifling causes; thus reproducing an ulcer upon the old site. The ulcerated surface is also liable to an early transformation into a condylomatous surface, while the sore still retains its specific qualities, and is quite capable of transmission by inoculation to a previously non-infected subject; a fact of much importance in serving to explain some of the cases where the transmission of secondary affections is alleged to have occurred. This transformation of the indurated chancre into a condylomatous surface has been denominated "*a transformation in situ*." The tender, easily excoriated surface of a cicatrized indurated sore is specially liable to become affected by the soft chancre virus, if the part is exposed to it; the result being that a soft chancre with its ordinary characters becomes engrafted upon the special characteristic of the indurated infecting chancre. In such circumstances, the history of the case can alone preclude the risk of error in coming to any conclusion as to the true nature of the sore and its consequences, or prevent false conclusions in experimenting with the virus obtained from it. This form of engrafted chancre must, however, be carefully distinguished from what has been called the mixed chancre.

The mixed form of Chancre.—Here the patient, from a suspicious connection, has been exposed to the influence of the virus of both the soft and the indurated chancres. Within a few days, the soft chancre appears, with its characteristic pustular commencement, and runs its usual course

for days, or it may be weeks ; then gradually the characters of the indurated chancre develop themselves, so that the sore, which at first was an undoubted soft non-infecting one, ultimately acquires all the characters of the indurated and infecting chancre, and is followed by constitutional syphilis, with its usual results.

The diagnosis of indurated chancre is not equally easy in all cases, or at every period in the history of the sore. Were we, in fact, confined in our determination of the specific characters of the sore to the ulcerated surface, and the state of its base, very great difficulties, indeed, would constantly arise. The glandular enlargements by which it is constantly accompanied, and the existence of a period of incubation ere the sore became developed, will, when taken with its local characters, usually suffice to determine the true nature of the sore, and enable us to arrive at a prognosis, with as little risk of error as can be expected in any disease.

The prognosis, in a case of indurated chancre, should be, that constitutional symptoms are absolutely certain to occur in all cases, within six weeks from the commencement of the sore ; unless, indeed, treatment has been adopted of a kind to interrupt the ordinary evolution of the phenomena of the disease. These symptoms, at first quite superficial and general in their character, become, as the infection grows older, more localized, and more liable to affect subcutaneous parts and internal organs.

Treatment.—No treatment which can be employed will altogether prevent the development of constitutional symptoms when the sore has once formed. Caustics may be used with the view of preventing the communication of the sore to others, but neither cauterization nor excision can save the system. The virus, during its period of incubation, has been absorbed, and has acted upon the system ; the first fruits of such constitutional contamination being evidenced in the induration of the base of the sore, and the formation of the indurated glandular chains in the neighbouring lymphatics. No doubt, both Ricord and Sigmund, in their vast clinical experience of chancres, have found that sores destroyed by the more powerful caustics, within from three to five days after their commencement, have not been followed by syphilitic symptoms. But this, which is undoubtedly a fact, can only apply to the soft chancre, which, from the rapidity with which it appears after exposure to infection, and the pain which attends upon it till it attains its period of decline, is sure not to be overlooked. The indurated chancre, on the contrary, having a long period of incubation, being usually a painless, unobserved affair, during its early stage, and not attracting attention until its size or situation make its presence sufficiently obvious, is not likely to afford an opportunity for such early ectrosis. It is so far well, therefore, that we find both experience and analogy proving the complete uselessness of ectrotic treatment in the case of the indurated sore. Nay, further, ectrotic attempts sometimes only serve to excite additional destruction of tissue, with the development in the parts around, after the slough formed by the caustic has separated, of a fresh induration, which tends to render cicatrization of the sore a more tedious matter than otherwise it would have been. The best application which can be made to the sore is a weak astringent, such as the sulphate

of copper or zinc lotion—the latter especially—with the addition of aromatic tinctures. The calomel and lime-water wash also constitutes an excellent application. From time to time the pencilling of the ulcerating surface with the solid nitrate of silver, with subsequent application of dry lint for twelve hours thereafter, tends very materially to hasten the progress towards cicatrization. Nothing, certainly, has so manifest an effect in promoting the absorption of the induration of the base and margins of the ulcer, and therefore the cicatrization of the surface, as the administration internally of some preparation of mercury, or even the application of blue (mercurial) ointment as a dressing to the sore itself. This effect of mercurial treatment forms a strong contrast to the results of mercury in the soft chancre; tending, as it does, in the latter, to delay the healing of the sore; and, when pushed so far as to affect the system, obviously inviting the occurrence of phagedæna. In no case, however, of indurated sore is the use of mercury essential to induce the process of healing. Simple means will suffice for this; although the progress of cure may be tardy, compared with that when mercurials are employed.

Phagedænic Chancre, Sloughing Ulcers of the Genitals, and Sloughing Phagedæna.

Phagedænic or sloughing sores occurring upon the genitals may be altogether unconnected with any exposure to venereal contact. This simple phagedæna, however, is a very exceptional form, and usually occurs in patients whose system is worn out by the pre-existence of some exhausting disease. Phagedænic sores which are of the nature of chancres may belong to either the sort or the indurated species. Most commonly they are of the former kind; the tendency to phagedæna being one of the characters of the soft chancre. So unusual, in fact, is it to meet with an infecting chancre which undergoes the phagedænic degeneration, that the occurrence of phagedæna has by some been regarded as a preventive of syphilis. This clinical experience, although practically still a valuable aid in prognosis, must not be considered as absolutely correct; for we must recollect at the same time that other pathologists have attempted to shew, that more serious constitutional symptoms of syphilis follow upon the phagedænic than upon any other form of sore; and practical surgeons have long since concluded that while mercury is injurious in nearly all cases of phagedænic ulceration, there are some phagedænic chancres which obstinately resist all other treatment, and improve rapidly when mercurials are employed. Phagedæna then must not be considered as a variety or species of chancre, but merely a complication of the chancre—soft or indurated as the case may be—occurring most frequently in the former, and rarely in the latter. Why this is the case we do not know; any more than how it is that an attack of erysipelas, supervening upon phagedæna, usually arrests the progress of the ulceration. When phagedæna attacks an indurated chancre, it is usually far less destructive than when it complicates the soft form of sore; the degree of destructiveness and the tendency to extension of the ulceration varying in each case. This, in fact, is so true, that the characters of the

original indurated chancre may be regarded as foreshadowing the consecutive or constitutional symptoms which are certain to follow upon it. When the indurated sore is slight, superficial, and tending to heal, a mild train of constitutional symptoms without suppurative tendencies may be expected ; when, on the other hand, this form of chancre becomes phagedænic, we may anticipate severe pustular and ulcerative affections of the skin and mucous membrane, affections of internal organs, and suppurative lesions of the bones.*

Phagedæna, occurring as a complication of either form of chancre, may be either acute or chronic. The latter is not in itself very formidable—being usually the type assumed when the sore is of the indurated class ; commencing under cover of the prepuce, it may confine itself to the balano-preputial fold, and cease to extend after it has destroyed the frænum. When, however, the soft chancre assumes this complication, the sore may burrow beneath the skin of the penis, producing much brawny thickening and swelling of the organ, with copious foetid discharge ; advancing unseen and unchecked, till much mischief may be done ; probably opening into the urethra, at one or more points ; at all events, laying the foundation of tedious sinus, with perhaps a permanently enfeebled and abnormal state of the organ. Sometimes, also, this form of sore attacks the posterior part of the dorsum of the penis, and burrows beneath the pubes, especially when commencing in suppuration of the lymphatic vessels. (Figs. 31, 32. Pp. 123, 124.)

Acute phagedæna, the sloughing sore, and the sloughing phagedæna, present the same characters here as elsewhere ; attacking the glans, prepuce, and open bubo, indiscriminately ; and in a short time effecting the



Fig. 339.

most destructive ravages. The accession and progress of the sore, or sores, are accompanied with marked constitutional disturbance, of the nature of irritative fever, tending manifestly to prostration. The sinister characters may declare themselves from the first ; or, for a day or two, the sore may seem but a particularly foul and active sample of the soft chancre, attended with an unusual amount of constitutional disturbance ; and then, without any apparent exciting cause, rapid aggravation takes place, in both the local and constitutional symptoms ;

constituting what is ordinarily termed the “black lion.” Sometimes such aggravation would seem to be accelerated, if not caused, by the administration of mercury, in the form of so-called “vegetable pills.”

It is important to discriminate between the sore originally of a bad kind, and that which, by such casualty as inattention to cleanliness, mere irritation by friction, or the injudicious employment of stimulating local applications, has become temporarily occupied by a slough ; for the suitable treatment is very different. Active and painful local management, with constitutional remedies, is required in the one ; rest and simple antiphlogistics are sufficient for the other.

* Bassereau, *Traité des Affections de la Peau Symptomatiques de la Syphilis*, chap. vii.

As the disease advances unchecked, constitutional disturbance increases proportionally ; and this, becoming decidedly typhoid, may prove fatal. Or it may be assisted by hemorrhage. Moderate and spontaneous loss of blood, however, may have an opposite effect, in the less urgent cases ; occurring in quantity sufficient merely to affect the part ; and not to such an extent as to depress the system. In most cases, a fatal issue may be avoided ; but, in many, serious mutilation is inevitable. Such destructive results are best marked in the case of chronic serpiginous ulceration—specially liable to occur as a complication of the specific bubo of the soft chancre—extending down the thigh over the anterior and lateral surface of the abdomen and flank, and advancing at one part while perhaps it heals at another. The edges of this serpiginous variety are for the most part thin, livid, and œdematous, and so extensively undermined that they fall down upon the excavated surface, and conceal the margin where the ulceration is extending. This undermined edge can sometimes be raised on a probe, and folded back upon the sound skin ; usually presenting a very irregular margin, perforated here and there by the ulceration from beneath, and liable, under a sudden exacerbation, to perish piecemeal in the form of a slough. The disease, fortunately, is comparatively rare as an epidemic ; and, when it occurs as such, is chiefly found in maritime towns, where by sailors and the lowest class of prostitutes sexual vice is extravagantly perpetrated.*

To change the character of chronic phagedæna, no local application is so powerful as the fluid nitrate of mercury, diluted, so as to have an alterative rather than an escharotic effect ; and a strong solution of sulphate of copper has also beneficial influence, applied to the surface by means of a hair pencil once in two or three days. The lotion formed of nitric acid, of chlorinated soda, or Condyl's fluid sufficiently diluted, has a material influence in checking progress, in diminishing fœtor, and acting as a corrective. But nothing is at once so efficient, and yet so comparatively painless in its application, as the solution of the tartarized iron—of the strength of half an ounce of the salt to eight ounces of water. When the presence of indurated glands in the groin indicate that the sore has been originally of the indurated species, the use of the more powerful caustics will not be followed by the same satisfactory effects as in cases of phagedænic soft chancres. The primæ viæ are attended to ; regimen is antiphlogistic ; warm bathing is useful ; strict rest is enjoined ; and iron tonics are administered frequently, in such doses as the stomach will bear.

Acute phagedæna, the sloughing phagedæna, and the sloughing sore,

* “Most of the young creatures who are brought from that genteel place, Swan-alley, afflicted with phagedænic ulceration, have had very little wholesome food ; they are generally kept by Jews and Jewesses, who give them plenty of gin, though but little proper nourishment ; they are half-starved, and, more or less, in a continued state of excitement and intoxication, having connection with Lascars, and other dirty foreign seamen, as many times in the day as there are hours. In this manner, their constitutions must soon get into a very disadvantageous state for the favourable progress of any disease whatever ; and we cannot wonder that their impaired and imperfectly developed frames, their course of life, and uncleanness, should promote phagedænic ulceration, and give it an unusually severe character.”

—S. COOPER.

require the active treatment, locally and generally, suitable to this form of disease in general ; the clearing out of the primæ viæ, followed by sedatives and anodynes ; stern use of an active escharotic, the characteristic moisture of the sore having been first removed ; strict rest, an antiphlogistic regimen, and the use of iron internally ; but, at the same time, a careful watching of the constitutional symptoms, lest typhoid tendency suddenly supervene, and stimulants become indispensable. Cover the part in a poultice, treating the case expectantly, as is the manner of some—serious mutilation will be the probable result.

In the outset of an urgent case, one is tempted to imitate nature, and abstract blood. But, generally speaking, the experiment is a rash one ; it may irreparably depress the system. While, however, bleeding from the system is unwarrantable, abstraction of blood may sometimes be made from the part, safely and well. A pendulous, half-dead portion of prepuce, soon about to slough wholly, may be cut off by the stroke of a bistoury ; and bleeding from the wound may be encouraged, to such an extent as may be deemed suitable and safe. Also, in every case where the undermined condition of the skin, the existence of a tumid prepuce, or any other local complication, renders efficient application of the caustic to the whole of the ulcerating surface impossible, the knife or scissors should be employed as a preliminary means of exposing the part.

Sometimes paraphymosis occurs ; as can be readily understood, on account of the swollen state of the parts. This must be instantly remedied by replacement, if possible ; if not, a free liberating incision should be made on the dorsum of the penis, at the constricted part ; otherwise, the progress of destruction cannot fail to be frightfully aggravated.

After cicatrization has been completed, it may be in our power partially to remedy the damage done, by closing abnormal apertures in the urethra by means of autoplasty.

Mercury is never advisable except in extremely obstinate examples of the indurated phagedænic form. In such circumstances, iron and quinine will always be advantageously combined with the mercurial, which should be employed with the greatest watchfulness.

Bubo.

Venereal Bubo may be of four kinds. 1. The sympathetic bubo due to *simple inflammatory Adenitis*, such as occurs in cases of acute gonorrhœa, and which may also complicate either of the forms of chancre. 2. *The specific or virulent bubo*, which so frequently complicates the soft form of chancre. 3. *The multiple and indurated glandular enlargements*, which necessarily accompany the indurated chancre. 4. Scrofulous glandular enlargement ; due to the pre-existence of some source of irritation, venereal or otherwise, in the parts—the lymphatics of which communicate with the affected gland.

These different forms of glandular enlargement may co-exist in the same glandular chain ; occurring at the same, or at different periods ; and hence causing at times considerable confusion in diagnosis and prognosis. In well-marked cases, they have sufficiently distinctive characters ; and confusion need not be regarded as the rule, but rather as the exception.

1. The Sympathetic Bubo, or simple inflammatory affection of the glands which lie in connection with the part undergoing the inflammatory or ulcerative disease. This occurs in cases of acute gonorrhœa ; and may also be excited by the soft or even the indurated chancre, acting as a simple source of lymphatic irritation—especially when the parts are stimulated through exercise, debauchery in drink, or other folly of the patient. In some rare cases of gonorrhœa, it commences even before the discharge from the urethra has as yet set in. In such cases, where a previous painful experience has taught the patient, who has exposed himself to the risk of incurring such a consequence, what he may expect, he will frequently seek advice when as yet nothing but redness of the urethral orifice, and glandular swelling and tenderness exist, to indicate what is about to ensue. The swelling and tenderness at first are confined to the gland or glands, and, should resolution ensue, affect nothing else ; but if suppuration occur, extension takes place to the surrounding parts, matting the glands together into an irregular mass, which occupies the fold of the groin along the line of Poupart's ligament. When the abscess is evacuated, the pus that escapes has no virulent qualities, and gives no results on experimental inoculation ; nor do the edges of the incision become chancreous ; nor is healing delayed if the opening is free, and if no sinus, by too long delay in affording an opening, has formed in surrounding parts.

2. *The Specific or Virulent Bubo* may occur upon one or both sides of the trunk, according to the situation of the sore, and engages one or more sets of lymphatic vessels. It is due to absorption of the chancreous matter, from the surface of the soft chancre. The matter is conveyed by the lymphatic vessels, and deposited in the first gland in the neighbouring lymphatic chain. Here, and sometimes in the lymphatic vessels which communicate between the sore and the affected gland, suppuration is established ; and, whatever treatment may be employed, the inevitable result is the formation of an acute intra-glandular abscess, which, making its way through the capsule, either spontaneously opens after undermining the superimposed integument, or is evacuated by incision. In the former instance, several openings usually form, and sinuses are apt to burrow among surrounding parts. In all circumstances, the matter within the gland is chancreous in its properties, and will produce specific results upon inoculation, either in the patient himself, or in any one else. The edges of the opening, accordingly, which is made to evacuate this abscess, become inoculated, and the gaping aperture in the groin becomes a large soft chancre. Strangely enough, however, a second virulent bubo never forms by absorption of the matter from this. In some rare cases, an abscess is produced both within and external to the affected gland ; and the pus of the former is specific, while that of the latter is simple. These collections usually coalesce before an opening takes place ; but the pus of the external one, when it is prematurely evacuated, will be found to possess different qualities from that formed within the gland, as may be proved by experimental inoculation.

3. The bubo which necessarily accompanies, and is pathognomonic of, the indurated chancre, is an early concomitant of this affection ; and, by the time the induration of the chancre is recognised, will always be

found to co-exist, in an equally or even more developed state. The enlargement, unlike the previous forms, affects all the glands in the neighbouring lymphatic chains. These are moderately enlarged, seldom exceeding hazel-nuts in size, and are like the base of the sore ; that gland which is nearest the site of the chancre being usually slightly larger than the others. It is so rare for the bubo of an indurated chancre to suppurate, that it may, in many cases, almost be taken for granted that if a suppurating bubo has existed, it was not accompanied by an indurated sore. This must not, however, be accepted as an invariable rule ; for from the co-existence of a soft chancre, or from the indurated chancre having been irritated, the swelling in the groin may have terminated in the formation of an abscess. The indurated enlargement of the glands is not only indolent, but very persistent, existing for a very long period, and hence forming one of the best and truest sources of information, in expiscating the patient's antecedents, with reference to the question of the pre-existence of syphilis.

A further glandular involvement is also observable, affecting, in cases of syphilis, more or less markedly, all the lymphatics in the body. It in all respects closely resembles that which affects the lymphatic chains lying in close proximity to the indurated sore. The easiest position in which to seek for this indurated concatenate enlargement is along the anterior margin of the trapezius muscle. Grasping the nape of the neck in the hand, and passing the fingers downwards, the enlargement, if it exist, can be readily investigated without exciting the suspicions of the patients or their friends. This distant glandular complication usually disappears sooner than that affecting the chains of glands in close proximity to the site of the originating sore.

The enlargement of the lymphatics in syphilis, both proximate to the chancre and at a distance, must, along with the induration of the base of the sore, be considered as occupying the position of a *secondary*, or constitutional affection—the sore itself being the primary affection, or source by which the virus gained an entrance to the system.

4. The Scrofulous Glandular Enlargement may occur from simple adenitis, or may complicate the bubo symptomatic of syphilis.

One gland is usually prominently affected, remaining persistent in spite of treatment, and usually terminating in tardy and indolent supuration. In such cases, the progress of the affection is quite that of the common scrofulous disease of the glands, which is so often met with in the neck of strumous children.

In their early stages, the first two forms of bubo cannot usually be distinguished from each other. In treatment, however, both require the same measures—repose in the recumbent posture, the use of warm acetate of lead and opium fomentation, and either destruction of the soft chancre with a powerful caustic, or, should the patient object to this, the use of simple soothing measures to the sore till the glandular irritation is subdued. In the case of an acute bubo accompanying gonorrhoea, the measures already recommended for allaying the urethral pain and irritation should be sedulously adopted ; and if the use of an injection is persevered in, it should be of an opiate and soothing kind. When either the virulent or simple bubo begins to suppurate,

poultices should be substituted for the fomentation, and the opening should be delayed till the matter is pointing through the skin and threatening to evacuate itself spontaneously. By this delay the gland capsule is fully opened up, and all risk of a sinus communicating with the interior of the gland, followed by tardy cicatrization, will thus be avoided. The incision should be free, in most instances, to avoid the necessity for repetition of the opening; and as conducing to more speedy healing, the tissues should be divided crucially, the knife passing through the whole extent of the elevated surface of the swelling in both directions. Some recommend that such buboes as accompany the soft chancre should be opened with caustic, or that caustic should be applied immediately after the matter has been evacuated by incision. Could we be certain beforehand that the bubo was of the virulent kind, this advice would be reasonable—one operation thus serving to open the purulent collection, and to transform the abscess-sac from a chancre into the condition of a simple sore. Unfortunately, however, though we may surmise that the bubo is virulent, we can never be certain that it is really so, until after evacuation we have an opportunity for either practising experimental inoculation with its contents, or of observing the spontaneous progress of the part subsequently. Besides, opening the sac with caustic is painful and tedious; and when the knife is used as a preliminary, the flow of blood, by diffusing the caustic, interferes with its accurate application, and may cause it to act injuriously upon the surrounding parts. We should, therefore, first evacuate the matter with the knife as already described, and then in a few days resort to the caustic, should the character of the sore in the groin indicate the propriety of such a procedure. The employment of caustic, too, is always better than clipping away the undermined skin, which covers in or overlies the sac of the bubo which has been inefficiently opened, or has been permitted to evacuate itself spontaneously. By some it is recommended, instead of employing a free incision, to paint the pointing bubo with a solution of the nitrate of silver, and either to permit the matter to find its own way out, or to make a number of needle punctures through which it may flow, and through which the nitrate of silver solution, or other astringent, may be injected from time to time, while pressure is maintained over the surface by means of a pad of cotton-wool and a spica bandage. In such cases the painting should be persisted in from day to day, till the discharge ceases and all is firmly healed. In favourable cases the discharge diminishes very speedily, the parts ultimately becoming adherent; and cicatrization when effected may even leave the groin unseamed and almost unscarred. This plan has a further advantage claimed for it, that it does not require the patient to lay himself up; admitting of young men, in many instances at all events, going about and attending to their usual daily avocations; this non-interference with their work being in their eyes, and in my own experience, the only recommendation which this somewhat unsurgical proceeding possesses.

The indurated bubo requires no special treatment; yielding to that suited to the syphilitic infection of which it forms a part. When one of the glands, however, continues enlarged, the use of the tincture of iodine painted over the swelling, or of the mercurial ointment, or of the

gum and mercurial plaster applied to the part, will be found very well adapted for inducing gradual removal of the enlargement.

The scrofulous glandular affection requires nothing further than the treatment already described when the parts are tender and inflamed. Stimulation by means of a blister is, however, usually advisable when suppuration is threatened, or when the swelling remains undecided whether to suppurate or resolve.

The aperture in the groin, which remains after the opening of a bubo, usually requires support and pressure by means of a pad and bandage, as well as the employment of an astringent lotion ; and in many cases tonics and cod-liver oil will be found specially adapted to the state of the patient's health and strength. In some very chronic cases of prolonged suppuration or tedious progress towards healing in a sinus in the groin, which runs deeply among the tissues, hot sea-water bathing, with blistering and pressure, will be found of great service—preventing the necessity of extended and deep incision.

It was a question at one time whether or not bubo may be truly a primary form of syphilis ; occurring without the formation of sores, of any kind, on any part of the penis ; capable of producing venereal sores, by inoculation of the matter which may form by its suppuration ; and liable, when of the multiple and indurated kind, to be followed by constitutional pox. Such buboes "*d'emblée*" never occur. They are always the result, more or less remote, of a chancre which has been overlooked.

Bubo of the Penis is said to exist, when the lymphatics on the dorsum are continuously affected by inflammatory disease ; and when—usually about the middle of the organ—painful swelling takes place, with much inflammatory product, threatening to advance to central suppuration. Pus generally forms ; and may be at once evacuated externally, or may burrow extensively beneath the fascia. Treatment is by rest, and fomentation, in acute cases.

Condyloma.

Condylomata are tubercular elevations of the integument ; sometimes white upon the surface, as if the elevated part had been pencilled over with nitrate of silver ; sometimes of a mucous pulpy appearance, and dark reddish-brown or copper colour ; sometimes dry, and covered with a desquamating and fine cuticular layer ; sometimes exhaling a copious, thin, acrid, and very foetid discharge ; forming usually on the nates, around the anus, in the folds of the thighs, on the perineum, on the scrotum—in the female on the labia ; but also affecting the lining membrane of the prepuce, the surface of the glans, and the orifice of the urethra. The angles of the mouth, the commissure of the eyelids, and also of the toes, the cavity of the umbilicus, the axilla, and folds of the cutaneous surface, may also become affected. In females who employ large quantities of oil in dressing the hair, and in whom the hair hangs over the neck, well-marked condylomata may even appear on the skin of the nucha. The secondary affections of the buccal, faucial, and vaginal mucous membrane, consisting of elevated, and more or less rounded, oval, or elongated patches, with a whitened surface as if acted on by nitrate of silver, or coated with milk, are also of this nature.

When condylomata first appear upon the surface, they present a rounded form, not usually larger than a pea or threepenny piece ; but by persistence, they may attain to the size of a florin ; and by coalescence, a cluster of such tubercles may ultimately form a figure of irregular outline, occupying a considerable extent of integument. Occurring in a fold of the skin, they sometimes develope in the direction of the crease, and assume an ovoid or spindle-shaped outline. Ulceration may also complicate the appearance of the condyloma ; or their surface may become inoculated with the virus from a soft chancre, and thus the characters of the simple soft sore may become engrafted on those of condyloma.

This, however, is essentially a secondary affection, consequent upon pre-existence of the indurated chancre, and usually, in females, occurring among the earliest of constitutional affections ; but belonging strictly to the period of the scaly and tubercular eruptions of the general surface, and accompanying the elevated white patches of the mucous membranes. Condylomata, in fact, are mere transformations of co-existing eruptive affections of the scaly or tubercular type ; and their origin can be traced to local causes, which tend to induce this peculiar transformation. For example, the spots of lepra which are present on the groin and abdomen, will, as they approach the scrotum, become more elevated and less inclined to desquamative change, while those occupying the opposed surfaces of the scrotum and inner side of the thighs, will present all the characters of the condylomatous patch. Again, the ordinary lepra spots, by poulticing, may be converted into condylomata ; and the condylomata which exist may be transformed into scaly spots by mere attention to cleanliness, and keeping the surface free from moisture, either by securing evaporation, or by the use of desiccants.

In such circumstances, the manifest cause of the formation, and long continuance of the condylomata during the various transformations or changes which occur in the general cutaneous eruptions, is plainly referrible to the site they occupy. The situation in which these affections form is, in all cases, one which is kept more or less constantly moist and tender ; either from the existence of an acrid secretion, or simply from a want of attention to cleanliness, and consequent accumulation of the cutaneous secretions upon surfaces in close contact, and exposed to mutual friction. These determining causes of the condylomatous form of eruption have led some surgeons to regard them as non-specific affections, due simply to moisture and irritation. Now, while warts, with which, by some, condylomata have been confounded, are often undoubtedly due to such a cause—and to no other, which is essential—condylomata can never occur without the pre-existence of the indurated chancre. Evidence of the existence of this will very generally, in male patients, be found in the presence of the indurated chancre itself, or at least of the indurated cicatrix, as well as of other cutaneous eruptions ; and certainly the multiple glandular indurated bubo in the neighbouring lymphatic chain will not be wanting. In the female, again, the condylomata may be early developed before other cutaneous manifestations have appeared, and the induration of the chancre may even be already unrecognizable ; for in them the site of the chancre is far more likely to be overlooked, and the induration to have been superficial and evanes-

cent. But the characteristic bubo will here, too, preclude the careful observer from failing to recognise the syphilitic infection.

By some, condylomata are supposed to be communicable—to constitute, in fact, a primary but peculiar form of syphilis ; by others, they are regarded as susceptible of communicating the regular indurated chancre to any healthy individual inoculated with the condylomatous secretion, or coming in contact with such a surface, as during coitus. In favour of the first of these views, the presence of symmetrical patches of condylomata, developed in parts naturally in constant contact, has been adduced as an argument. When these parts are on opposite halves of the surface, as in the case of the nates, the tendency to symmetrical development of eruptive affections, which owe their origin to a constitutional cause, should suffice in reply. When, however, they are upon contiguous surfaces upon the same side of the body, as in the case of the scrotum and thigh, the existence of the determining cause, viz., filth and moisture, acting most effectively upon the corresponding surfaces where the moist condylomatous patches already existing upon one side present these qualities in greatest perfection to the skin upon the other, symmetrical development of the eruption is only what should have been anticipated. Neither need it be matter of wonder that in females coming under treatment for syphilitic affections of the genitals and skin, the disease of the vulva, on admission into the hospital, should be found to consist of nothing but condyloma without any trace of an indurated chancre. For while this is not by any means uniformly the case, the indurated chancre or its cicatrix being often easily detected, especially when it has existed elsewhere than upon the genital organs—the indurated multiple bubo will always be found to exist, whether the chancre can be discovered or not. That it should not be detected in most of the cases, is due sometimes, it may be, to want of careful search ; sometimes to looking for it on the vulva or genital organs only ; sometimes to ignorance of the frequent existence, especially in such a favourable locality, of the transformation *in situ* of the indurated chancre into a condyloma, as has already been mentioned.

In contradiction of the second of these views, viz., that the condyloma is capable of communicating syphilis by inoculation or by contact to a healthy individual, the liability to mistake as to the real source of the virus which has been employed should be borne in mind ; and the chance of the condyloma being an indurated chancre in process of transformation *in situ*, should be duly weighed ; while the possibility of the patient inoculated with the matter derived from the condyloma having the experiment vitiated, by the inoculated surface or the rest of his body being exposed to other sources of syphilitic contagion, should be carefully guarded against. At the same time it must be admitted that the facts adduced in favour of the inoculability of secondary lesions, and more particularly of condyloma, as competent to produce the indurated chancre, its accessory bubo, and a syphilitic systemic radiation, has within the last few years gained more ready belief than ever before. By some, the facts adduced in evidence are still explained away ; by others they are too readily received without due allowance for inaccuracy or fallacy being attended to ; while others, whose experience in such affections has been

most extended—although they have looked for such results, and even practised with more than doubtful propriety experiments for the purpose of deciding the point—have still to confess that while they would willingly give their assent to such a doctrine, they have not as yet met with facts which satisfy them as to its truth.

Those pathologists and practitioners who have come to believe in the communicability of secondary lesions, state—1. That the secondary affections which occur in young children, and are of hereditary origin, especially if they present the condylomatous form, are most communicable; particularly from a nursing to a nurse, and from the latter to one or more other children; or from one child to another, the vaccine virus forming the vehicle.

2. That the period of incubation in such cases is always a long one, extending in some instances to even forty-two days; the average of different experiments being from about twenty-two to twenty-six days.



Fig. 340.

3. That the resulting lesion is always a papule which becomes ulcerated and presents the character of the indurated chancre, with its characteristic bubo, and is followed by the usual train of constitutional symptoms.

In our own experience, while we have not felt justified in making experiments as some have done to satisfy their curiosity in this particular, we have had no such undoubted and otherwise inexplicable clinical facts as to lead us to accept the above propositions as absolutely proved. We see no reason, however, to doubt the good faith of those who have adduced such results; and would certainly counsel prudent adhesion to the side of safety in all manipulations in connection with secondary affections, especially when abraded and exposed surfaces exist, and should assuredly recommend that every precaution should be employed in vaccination to avoid the possibility of using the virus from an unknown and possibly vitiated source. Further, we acknowledge that

Fig. 340. Condylo mata.—ACTON.

it would certainly afford a very simple explanation of the occurrence of the indurated chancre in men who have connection with females in whom nothing capable of inducing contagion can be detected, unless condylomata have this power; and in which cases hitherto, roundabout means of contagion, or supposed falsification, has been the only means of eluding the dilemma. The difficulty, however, recurs that, on the other hand, patients are found to continue for months indulging in sexual intercourse with females who have condylomata of the vulva, and yet escaping scatheless; while the peculiarity of all such secondary contagions is, that the disease is always communicated from the female to the male patient, and never *vice versa*, except when a man suffering from secondary syphilis impregnates a healthy female, and through the medium of the foetus communicates to her the syphilitic disease—such communication not usually occurring until about the third month of pregnancy.

By some it is supposed that this affection is identical with “sibbens;” which at one time used to prevail much in this country.*

The treatment of condyloma consists in repeated applications of sulphate of copper, nitrate of silver, calomel, a weak solution of corrosive sublimate, or mere desiccants and astringents, until the tubercles disappear; in careful attention to the utmost cleanliness; in keeping the opposed surfaces on which they are situated apart from each other, by the interposition of dry lint; and in the use of such constitutional treatment as is thought suitable to the syphilitic infection.

Constitutional Syphilis.

The only means by which the syphilitic poison can enter the system, is, as we have seen, by the occurrence of the indurated chancre. When, then, the induration of the sore is recognizable, no means we can employ will altogether prevent the invasion of secondary symptoms. Local measures, such as excision of the sore, or its destruction by means of caustic, or its forced continuance in the open condition—these all have been tried and found fruitless. Similarly, every variety of constitutional treatment—mercury, iodine, “decoctions of the woods,” nitric acid, purgatives, the warm bath—may have an effect in modifying the progress of the disease, but cannot altogether prevent the appearance of the symptoms. In fact, at the present day, some consider all such treatment as really worse than useless; for they regard it as only calculated to delay the evolution of the symptoms—concealing their manifestation; and, when these do make their appearance, tending to render them of a more serious character than naturally they would have been. The great difficulty, therefore, now lies in determining with anything like accuracy what the natural history of the development and progress of the syphilitic infection really is, when left to itself, without any treatment to interfere with its spontaneous evolution.

That the poison enters the system, and affects every texture to a greater or lesser degree, is undoubted; but how this takes place has not

* SKAE, Northern Journal of Medicine, April 1844; GILLESPIE, Edinr. Medical Monthly Journal; RICORD's Lectures on the communication of Syphilis by Vaccination. Translated by Dr. P. H. Watson.

been satisfactorily determined. Some believe that the lymphatics form the portal by which it radiates its influences, others that the venous system acts as the channel for its conveyance from the sore into the general frame. Certainly, the lymphatics seem to be the parts upon which the poison first produces an anatomical effect ; and it appears not unreasonable to suppose that in them and the blood-forming glands generally, the virus is stored up which produces continuous effects upon distant and dissimilar parts during the early months of the systemic affection ; and that from them, too, an altered nutritive fluid is afforded, which determines the diseased conditions which sometimes, at considerable intervals—and these may be very long—evolve themselves, and constitute the later manifestations of the syphilitic infection.

Looking at the symptoms of constitutional syphilis, as they spontaneously discover themselves, we observe at once, that the affections which characterise the commencement of the disease are totally distinct from those which appear near its close ; and that with the advance of the disease the nature of the affections indicates a gradual deterioration of textural vitality, and a tendency to more destructive if to less acute results.

The early affections are for the most part superficial and acute ; implicating those parts which, as Mr. Hunter expressed it, are most exposed to cold. The later affections, on the other hand, are deeper seated, slower in their evolution, and more destructive in their tendencies. These two extremes, however distinctly and sharply defined from each other, are not found to be separated by any broad line of demarcation, but gradually merge, the one into the other ; so that we have a class of symptoms mid-way between the two, which, on that account, have been called *Transitional*—the symptoms on the one side being by some classified as *Secondary*, those on the other as *Tertiary*. There are, however, many who cannot admit such a rigid classification, believing that the symptoms are not only continuous but even transmutable. Something of this kind is undoubtedly observed, in certain cases, when mercury is administered ; the tertiary period being then advanced. By others, again, the term of tertiary is objected to *in toto* ; as they regard all the manifestations included in this period as due to the administration of mercurials ; and therefore they assign to these the name of *mercurio-syphilis* or *mercurial disease*.

Admitting without reserve the difficulty of completely separating between the secondary and tertiary developments, and recognising the convenience of the term *transitional symptoms*, we shall nevertheless consider constitutional syphilis as divided into *secondary* and *tertiary* affections.

The earliest indications that the system is already affected, and therefore in strict phrase the earliest symptoms of secondary syphilis, are the indurated base of the chancre, and the indurated glandular enlargements.

Next to those, which we have already fully considered, come the deranged state of the system indicated by the term chloro-anæmia, the syphilitic fever, the cephalic and osteocopic pains, which usually are more or less distinctly manifested in all cases before the appearance of

any cutaneous affection. The deranged state of system included under the term chloro-anæmia is generally indicated by a sallow appearance of the countenance, more or less emaciation, a sense of *malaise*, lassitude, muscular debility and headach, along with palpitation and disturbance of vision, sometimes with bruit de soufflé accompanying the first sound of the heart, audible both in the cardiac region and along the course of the blood-vessels in the neck, and sometimes with œdema of the lower extremities, and a tendency to epistaxis. That this condition is really due to a deranged state of the blood, and therefore accompanied by a general disorder of the blood-forming glands, is proved by the analysis of that fluid made by M. Grassi.* From this it appears that the proportion of red blood-corpuscles is diminished, while the white corpuscles and albumen are relatively increased. This condition is only a temporary one, however ; usually passing off within a brief period, and in most instances not again appearing.

Syphilitic Fever.—Although this symptom is recognised by most experienced authorities, it has been denied by others. It certainly is not of constant occurrence, but is frequently met with in patients who have not been subjected to treatment, usually commencing about ten days or a fortnight before the first manifestation of the cutaneous eruptions. When these appear, the febrile symptoms usually, though not constantly, pass off. The febrile reaction is generally ushered in by a shivering fit. Only one such attack may occur ; sometimes, however, the fever assumes a regular or irregular periodicity, and the regularity may be so complete, as to render it liable to be mistaken for a quotidian or tertian ague. It is usually after such disturbance that manifest gastro-hepatic derangement occurs, attended by diminution of the appetite for food, a foul tongue, a sense of nausea, and even diarrhœa. Headach is also a prominent symptom ; sometimes affecting the occipital and cervical regions, sometimes the forehead ; sometimes diffused over the whole cranium, at other times apparently of a neuralgic character, and affecting the supra-orbital or infra-orbital branches of the fifth nerve, on one or both sides. The osteocopic pains, which are so troublesome a feature of the early stages of syphilis, affect usually the articular ends of the bones. These, like the headach, are generally most severe at night, when the patient is warm in bed ; subsiding towards morning, and absent during the day ; and the parts, though rarely manifesting any further indication of the inflammatory process, are usually tender on pressure or movement. Pain is also sometimes complained of when the shafts of the bones, especially of the lower extremities, are firmly manipulated ; and recently the existence of sternal pain has been noted as an early and well-marked symptom.

Syphilitic Affections of the Cutaneous Surface.

No one form of cutaneous affection is specially diagnostic of syphilis. Very various forms of eruption, as we shall see immediately, may occur during the progress of the infection ; nay, nearly every form of skin eruption may exist, at the same time, upon the surface of the body. The usual course of events, however, is for the eruptive affections to manifest

* Ricord, *Leçon sur la Chancre*, 2d edit., p. 184.

themselves consecutively ; those which appear first being usually more generally diffused, and implying less derangement in the nutrition of the cutaneous textures, than those which occur later, and which produce more serious lesions of structure.

The best classification of cutaneous *syphilides* is that of Cazenave, who arranges them in the order in which they naturally tend to manifest themselves. It is as follows :—1. Exanthematous ; 2. Papular ; 3. Squamous ; 4. Vesicular ; 5. Bullous ; 6. Pustular ; 7. Tubercular.

Some authors speak of the *primary* and *secondary* syphilides. By the former are signified the condyloma, which we have already described ; shewing that, even according to those who claim for it a special power of communicating the disease, it never constitutes a true primary lesion—artificial inoculations practised with matter derived from a condylomatous surface, invariably producing the indurated chancre, and not a condyloma.

Although the eruptions of the cutaneous surface never fail in any case—usually appearing about the sixth week after the commencement of the indurated chancre—there are determining causes which appear to possess the power of hurrying on their development. Such are the lymphatic temperament, privations, violent exercise, the excessive use of stimulants, especially of malt liquors, and sudden alternations of temperature. They also occur at an early period in young children, infants, and females ; in such cases condyloma usually being the form first developed.

Certain general characters appertain to the Syphilodermata, no one of which possesses a special diagnostic value ; but when found combined in any case, they usually suffice, along with the patient's history, the other accompaniments, and the effects of treatment, to render diagnosis a very simple matter.

These characteristics are :—1. The coppery colour ; 2. Generally rounded form ; 3. Desquamative tendency ; 4. Persistence ; 5. Polymorphous character ; 6. Absence of pruritus.

Syphilitic Exanthemata.

These are of two kinds, the *Erythematous* and *Roseolar* ; and one or other, or even both combined, generally form the earliest cutaneous manifestation of constitutional syphilis. The usual date of their accession is from the thirtieth to the sixtieth day ; it is uncommon during the period between the sixtieth and ninetieth ; seldom occurring during the fourth month, they are exceedingly rare in the fifth. The eruption consists of rose-coloured spots, which seem seated in the texture of the cutis vera, and are unaccompanied by any thickening, elevation, or desquamation of the surface. The eruption may either be a uniform flush (erythema), or a mottled discoloration (roseola). The abdomen, front and back of the chest, the shoulders and upper part of the thighs, are usually the parts where it is most pronounced. It is extremely rare to find the eruption accompanied by any febrile reaction, local uneasiness, or rapid and spontaneous disappearance ; a circumstance which serves to distinguish it from the infantile exanthems, and from the resinous eruptions usually produced by copaiba. When the syphilitic exanthems are expected and looked for, it will usually be found that they appear gradually ; although, from the effects of violent exercise or warm bathing, they are sometimes

rapidly developed. As they subside, the mottling of the skin loses its bright hue, becoming reddish, then yellow ; sometimes almost violet in tint, and then giving rise to the "trout-back" appearance, by which term this form of eruption is recognised among soldiers (Hennen). The discoloration, in strict pathological language, now constitutes one form of *macula*. The usual concomitants of the syphilitic exanthems are scabs among the hair of the scalp, papular *corona veneris*, condylomata, scabs at the margins of the alæ nasi and at the commissures of the lips, enlargement of the cervical glands, rheumatic pains, and shedding of the hair.

Syphilitic Papulæ. Lichen Syphilitica.

This consists of small *miliary* or *lenticular* elevations of the texture of the true skin, which may be either generally diffused over the surface, or restricted to one particular part, clustering in circles around a common centre. It may accompany or follow the exanthems, but is, compared to them, a rare form of eruption. When they first form, the papulæ have usually a red rosy tint ; but after desquamating, and for a time presenting a glossy surface, they either disappear and leave behind a dark-coloured macula, to indicate their former site, or by coalescence or enlargement they sometimes become transformed into tubercles, or constitute an elevated surface with an irregular outline. This form of eruption may occur on any portion of the surface, and frequently spreads over the whole of the body, except the hairy scalp. The second month is its usual period for appearing ; it accordingly frequently accompanies the exanthematous affection, and then usually appears on the forehead. It may be complicated with iritis. It is rarely evanescent ; but, developing slowly, remains persistent for a long time. Although desquamation of the cuticle is common, suppuration or ulceration but rarely occurs. The affections with which it is liable to be confounded are—syphilitic tubercles, simple lichen, and acne. The *tubercles* do not belong to this early period, are of much larger size, involve the tissues more deeply, and tend to ulcerate. The ordinary *lichen* is always attended with febrile excitement, a violent prickly itching heat, and gastric derangement ; and is very evanescent. *Acne indurata*, again, is recognised by its site, and by the absence of the general signs of the syphilitic infection.

Squamous Eruptions. Pityriasis, Psoriasis, Lepra.

By some the scaly eruptions are regarded as mere desquamative changes following upon an erythematous, papular, vesicular, or tubercular affection. Such changes may, no doubt, be frequently observed, but do not constitute mere terminations, but true transformations, of one form of eruption into another.

Pityriasis is the form of scaly eruption which occurs most frequently upon the scalp, or other parts of the surface covered with hair. The patches are small, rounded, of a dusky red colour, and covered, particularly at the margin, with thin furfuraceous scales of epidermal tissue. These collect in large quantities, become detached in brushing or combing the hair, and fall as dandruff.

Lepra and *Psoriasis* may occur upon any part of the surface. The patches are larger than in pityriasis, still rounded (*Lepra*), and tend to extend marginally, the centre presenting a depressed red or coppery tint, with a white or silvery desquamating and slightly elevated border (Bielt). When the patches remain discrete, the affection is commonly called *Psoriasis Guttata*; when they coalesce and form irregular curved outlines, *Psoriasis Diffusa* or *Gyrata*. After the eruption disappears, the cutaneous texture occupied by them presents white depressions, due to absorption following on the modification of its nutrition, and the removal of its pigment.

When *Lepra* and *Psoriasis* occur upon the palms of the hands and soles of the feet, the appearance presented is very characteristic; a red blotch, pustule, vesicle, or bulla forms, and extends irregularly; the scarf skin becomes detached, and a dark red, coppery, tender surface is exposed, which is made more obvious by being set in a border of undermined cuticle. The exposed true skin is usually very tender, and becomes traversed by fissures, following the flexion lines of the parts. These bleed, and render a secretion, which may be either serous or purulent—possessing an offensive odour.

Vesicular.—The vesicular form of eruption is not so rare a symptom of syphilis as some seem to imagine, and tends to appear before the sixth month of contagion. The vesicles occur over the back and front of the trunk, and upon the extremities. They may be small and acuminate (*Eczema*), or large and rounded (*Herpes Syphilitica*), scattered or arranged in groups. The herpetic vesicles contain a yellowish citrine-coloured fluid. When large and irregularly grouped upon a dark coppery surface, they resemble in character the *herpes phlyctenodes*. When smaller, and aggregated upon a circular or ovoid surface, they resemble the *herpes circinatus*. In other cases, the centre of the vesicles becomes umbilicated; and when these are large, the eruption closely resembles, and has been mistaken for varicella. In other instances, the vesicles form upon the summit of a papule, which remains after the fluid has been absorbed, or has escaped by rupture of the vesicle. These eruptions, at a comparatively early period, usually terminate by forming thick, dark-coloured crusts, which are very persistent. When the scabs are removed, a superficial ulcerated surface is exposed; and when the crusts spontaneously separate, a depressed copper-coloured or dark purplish cicatrix remains for a long time, marking the site the eruption occupied. By degrees, however, the cicatrix becomes pearly white. The syphilitic nature of a vesicular eruption—besides the existence of general and special symptoms of the syphilitic infection—is distinguished by the absence of pain and acute symptoms, and by the dark colour of the areola and macula.

PUSTULAR : *Acne, Impetigo, Ecthyma, Pustulo-crustaceous Eruptions.*

If any credit can be attached to the account given by eye-witnesses of the form assumed by syphilis when it appeared in Italy in the fifteenth century, we should believe that pustular eruptions were then the usual type. Were this the case, it might be explained, either by the greater

intensity of the disease, or by the great degree of depression of system which existed in those who suffered from it. At the present day, certainly, the latter condition appears very frequently to determine the suppurative result.

The common site for the commencement of a syphilitic pustular eruption is upon the hairy scalp. Thence it may extend to the face and elsewhere. Sometimes it affects the lower extremities, while the rest of the surface is free. When the eruption occurs upon the limbs alone, it may afford a valuable assistance in the diagnosis of the nature of the disease. We shall see immediately the characters which appertain to certain of these pustular eruptions, as they belong to the earlier or the later stages of the syphilitic infection; but we may mention at present, that when they are generally diffused over the surface, they are for the most part connected with the early periods of the infection; when again they are localized, they usually belong to the later and transitional secondary period.* The pustular eruptions may assume either the *phlyzaceous* or the *psydraceous* form; the former the more usual type. The *Phlyzaceous* type is represented by *Ecthyma*; the *Psydraceous* by either *Impetigo* or *Acne*.

Syphilitic Ecthyma is the most common of the pustular eruptions; but, except in one form, is in reality a rare affection. It may occur upon any part of the surface, from the scalp to the lower extremities; but it is rare to find it generally diffused, being usually confined to one region. An early form of the disease produces the scabs or crusts among the hairs upon the head which is so common a feature of the beginning of the syphilitic infection, when a roseolar or squamous eruption covers the general surface. The commencement of this, as of all other phlyzaceous eruptions, as described by Willan, consists in the formation of a dense elevated papule, of a bright red colour, the cuticle of which, within a day or two, becomes elevated by the formation of pus between it and the skin. The pustule, thus rapidly formed, has usually a dark outline of a coppery or almost brown hue, resembling very closely, especially in cachectic cases, the *Ecthyma nigrum* and *cachecticum* of some dermatologists. In this form the pustule soon accretes into a scab or crust, of a dark brown colour, and flattened aspect, which has no tendency to increase by extension of the underlying ulceration. When this crust is removed, the superficial ulcer speedily heals, and leaves a slight, shallow, but permanent cicatrix, like that of vaccinia.

The deep variety of the ecthymatous eruption occurs at a later period in the syphilitic development, generally accompanying the affections of the testicle, and nodes of the bones. It, in other words, appertains to the transitional class of symptoms, and lies midway between the early secondary and the later tertiary affections. The formation of the pustule follows the same progress as has just been described; but here the crust enlarges, the ulcer beneath being more deeply seated, and having a tendency to extend its limits. The scab which results is there-

* A fact which obviously had not escaped the keen observation of Gabriel Fallopius, who, writing in the sixteenth century, says—"When the pustules invade the whole body, and when they are developed in the hair and beard, it is a sign that the French disease has been contracted within five or six months."

fore somewhat cup-shaped, being formed by a series of eccentric or marginal additions, the central portion, which was first formed, being thinnest ; the external rings, which sometimes overlap, and at other times lie within the ulcer, being thickest. On removing the scab, the ulcer usually shows an abrupt irregular outline, the surface, especially around the margin, presenting an ash-grey coating. Sometimes the central portion appears covered with a crop of weak flabby granulations. The cicatrix which results is usually of a dusky red or coppery tint, darker around its margin than in the centre, gradually becoming of a dull white hue, but never exhibiting the regular punched out pit which is so characteristic of the earlier and less destructive form of ecthyma. This late variety of ecthyma, attended by deep seated ulceration, has very frequently been found to follow in the train of the phagedænic indurated chancre ; and may be held as a touchstone of the cachectic state of the constitution, usually presaging serious mischief in the future, with, in all probability, tendency to the implication of internal organs in the tertiary period.

Impetigo.—The pustules of syphilitic impetigo are variable in size, usually flat, the thickened and papularly elevated cutis being affected centrally by the ulceration ; a crust forms of a granular aspect, and greyish or greenish-yellow colour, elevated above the surface, the centre and not the margin being most prominent. When the crust is detached, or separates spontaneously, the ulcerated surface will be found to present different aspects, but has a special tendency to the formation of a central elevated granulating prominence. In cicatrizing, progress is usually made from the circumference towards the centre ; sometimes, however, where the ulcerous patch has formed from the coalescence of several impetiginous pustules, the cicatrization may begin from some of the central islands, and extend marginally. When patches of ecthyma or impetigo form by confluence, a large ulcerated surface becomes covered by a continuous crust, which continues to extend marginally ; such eruption is usually denominated *Pustulo-crustaceous*, by French dermatologists. It only occurs in the more advanced or transitional secondary period, and always leaves an excavated cicatrix, marked and seamed as if the surface had been produced by a deep scald.

Impetiginous eruptions most commonly occur upon the face, especially the alæ nasi, commissures of the lips and eyelids, the margins of the eyebrows, and among the beard or whiskers ; sometimes also upon the mons veneris and scrotum. When these impetiginous ulcers form upon the extremities, they have a greater tendency to extension than when upon the head, face, or scrotum.

Acne.—In syphilitic acne the pustules are usually small, acuminate, seated upon a prominent papular base, have little tendency to extend, and are essentially chronic in their progress. The scabs which form are generally small, dry, yellowish, or yellowish brown. On separating, a dry desquamating papule of a dusky or coppery tint remains, constituting when the syphilitic acne occurs upon the face or back, the most distinctive characteristic by which we recognise its difference from the simple form of acne. Besides this, however, we usually find other early symptoms of constitutional syphilis to aid us in arriving at a true diagnosis. When syphilitic acne occurs upon the extremities, where the simple form may

be said never to form, the same difficulty in diagnosis need not be anticipated.

BULLOUS : *Pemphigus*, *Pompholyx*, *Rupia*.

In *Pemphigus* and *Pompholyx* the bullæ, or blebs, resemble those which are produced by drops of boiling water falling on the surface. Of a circular or ovoid form, they vary in size from an inch to more in diameter. The cuticle, beneath which a serous, sero-purulent, or sanguinolent fluid is effused, is but slightly elevated above the surrounding surface, which is usually more or less stained of a violaceous or coppery tint. The eruption may terminate in absorption of the fluid and desquamation of the separated cuticle, or in bursting or rupture of the bleb, and ulceration of the exposed surface of the skin.

This form of eruption is commonly met with in children born of syphilitic parents. The blebs may exist at the time of birth—especially when the infant is still-born—or may appear within a short time after birth. The most common site for the bullous eruption is upon the soles of the feet and palms of the hands ; where, in fact, the cuticle is thickest and yields least readily. *Pemphigus* in the child is not, however, necessarily due to syphilis ; occurring sometimes in unhealthy seasons among the children of the poor, and due in them to a cachectic state of the general health engendered by insufficiency in the nutritive quality of the food.

Pemphigus in the adult is a very rare affection ; unless, as some have supposed, the early stage of psoriasis palmaris is really of a bullous kind.

Rupia is by some classified among the pustular, by some among the bullous, syphilitic eruptions ; but as the question is wholly dependent upon whether, in the early stage, the elevated cuticle contains a purulent or serous fluid, it matters little under which head we place this affection. In most cases the preliminary condition consists of a papular elevation of the surface. Upon this a vesicle forms, containing a bloody serum. This in most cases is absorbed ; a crust forming in its place, of a greenish yellow colour. Ulceration is, however, progressing beneath, and adding marginally to the crust, which rises from the surface in a conical form, resembling in some cases a limpet, in others rather an oyster shell in shape. As the crust desiccates, it grows darker until the summit may become almost black. The margin of the crust is usually surrounded by a copper-coloured or violet-tinted areola.

When the crust is removed, the ulcer beneath is found to have a circular outline, with an abrupt sharply-defined margin, the centre occupied by an elevated granulating surface corresponding to the interior of the rupial crust. When left to itself, the scab usually separates before the central part has finally cicatrized. The granulating surface accordingly becomes again covered with a crust, if left exposed ; and the former appearance, in a modified degree, is reproduced. The cicatrix, when recently formed, is then elevated ; of a coppery or dusky colour. Under the slightest irritation it tends to give way ; at a later period, however, the cicatrix is depressed below the level of surrounding parts, and leaves ultimately an indelible white stain.

The face and upper extremities are the most common sites for this

very unsightly eruption. It is a late symptom, merging into the tertiary type, and accompanying affections of the bones, testes, and areolar tissue.

Rupia rarely occurs except in ill-nourished and feeble systems.

TUBERCULAR.

These, like the papulæ, consist of solid elevations formed by thickenings of the tissue of true skin. They differ, however, from them in being of a much larger size, in the greater thickness of the cutaneous texture engaged in their formation, in their tendency to ulcerate, and in the late period of their appearance.

There are tubercles, however, which belong to two different periods in the history of the syphilitic infection :—1. Those which terminate in desquamative changes and resolution ; 2. Those which terminate in ulceration.

Those which belong to the first class are like small shot, peas, or lentils ; sometimes, however, attaining the size of a cherry. They usually appear after the occurrence of one or more of the earlier cutaneous eruptions ; but may, after mercurial treatment, employed from the period of the existence of the indurated chancre, form the earliest cutaneous manifestation of the syphilitic infection. They may be sparsely scattered over the surface, or grouped circularly around a centre of healthy integument. The circle is sometimes continuous, sometimes broken ; or two or more circles may coalesce and form an irregular figure. Sometimes they cluster together in masses resembling a mulberry. They occur most frequently upon the face, trunk, and upper extremities ; but may appear on any part of the surface. They are usually of a ruddy or violaceous tint. Sometimes, however, they are pale, and exactly like the surrounding integument. The surface is usually tense and shining, tending to desquamate or even to form scabs. In the circinate variety, the spontaneous scaling and resolution of one crop of such tubercles is commonly followed by a fresh crop appearing external to and continuous with the former, the outline of the tubercular formation becoming thus gradually wider and wider.

2. Tubercles which terminate in ulceration. These usually form elevated masses or patches of a dusky red or violaceous colour, and of a rounded, oval, or irregularly circular form. The ulceration may commence at an early period of their progress, or be delayed till the tubercle has attained some development. The surface of the tubercle usually first desquamates, and then ulceration commences beneath the detached layers of cuticle. In other cases the ulceration commences in that portion of the diseased texture which was first affected, *i. e.*, the central. In other cases, again, the destructive process begins deeply, and not only destroys the thickness of the skin but penetrates determinedly ; as in some instances where the alæ of the nose are thus removed or perforated. The surface where the ulceration is progressing usually possesses the character of a serpiginous sore ; cicatrization following closely upon the progressive advance of the ulceration. In some cases the surface is covered by a thin crust ; in others, the crust is thick, and the formation of matter very copious. The form and progress of these tubercles, except

in so far as they are more destructive, resembles that of the first form. The cicatrices left behind present the same generally circular or rounded outline, and are at first of a dark hue; but ultimately they present a seamed appearance, of a dull white colour; and the depressions between these cicatricial bands usually mark the sites of the separate tubercular formations of which the patch was composed. The concomitants of these tubercles are the affections of the bones, testes, areolar tissue, and internal organs.

The ulceration attending upon the tubercular eruption is liable to be mistaken for *Lupus Eredens*; but may be distinguished, in that lupus usually exists before puberty, is accompanied by a greater degree of irritation, and ordinarily inflicts far less serious injury to the part, even after continuing for years. These tubercles are distinguished from cancerous affections, again, by their softer consistency, the absence of lancinating pain, and the integrity of the neighbouring lymphatics.

ULCEROUS.

These, appertaining to the secondary period, we have seen, may originate in several of the forms of eruption which we have considered; in the Vesicles, Pustules, Bullæ, and Tubercles. Their general characters consist in the more or less circular outline of their margins, their everted or undermined and serrated edges, their greyish, irregular surface, accompanied with an unhealthy gummy sanies containing blood and the detritus of the tissues, and usually possessing a foetid disgusting odour. The ulcers are sometimes actively extending, at others stationary; sometimes shewing no inclination to heal, at other times healing at one part and extending at another. There is rarely one sore; usually several. The surrounding tissues are never healthy; but present more or less thickening and discoloration. The situation of the sore is usually one where simple, non-constitutional ulcers rarely occur. Sometimes they heal beneath the crusts which form upon their surface; more commonly the crust separates before this occurs. The cicatrix usually forms from the margins towards the centre; sometimes, however, irregularly, or from the centre towards the margins; and leaves behind more or less deformity, proportioned to the depth and extent of the ulceration. Those which form from the existence of a vesicular eruption are ordinarily superficial and equably diffused. Those which accompany the early pustules affect the skin more deeply, are not usually confined to one spot, but diffused over the surface, and leave more or less pitting behind. Those which originate in the later pustules and bullæ are more commonly limited to one part, and are more destructive in their results; while the tubercular affections usually occur only in one part, are serpiginous in their character, and leave behind considerable deformity from puckering.

Treatment of Syphilitic Cutaneous Affections.

Without doubt this should be essentially constitutional; adapted to relieve the system of the vitiated state which the syphilitic virus has introduced, and of which these skin eruptions are only symptomatic.

The nature of this constitutional treatment differs according to the views held by each individual practitioner as to the effects of certain remedies, to which for long has been accorded the power of relieving the system of the poison. Others again, regarding the eruption as a natural effort of the frame to relieve itself of the morbid condition which has been superinduced, object to the employment of any remedial agent which shall effect the removal of the virus by any other channel than the cutaneous secretion. No doubt the syphilitic condition left to itself will in process of time undergo a spontaneous cure ; but how long a time may be occupied in that cleansing process cannot be determined by the data we at present possess ; unless indeed we regard the method of cure by syphilization—by the use of the decoction of the woods—by the use of purgatives, diuretics, sudorifics—by dietetics and the hunger cure—as equivalent to mere temporizing with the patient. Then, if this is granted, the time is still found to be very uncertain—six months, nine months, or a year, being the periods usually assigned as the probable dates within which a patient may expect to find himself rid of the tendency to the occurrence of cutaneous manifestations. We must, therefore, bear in mind that the mere fact of the disappearance of every trace of eruption will not necessarily secure the patient against the chance of a reappearance of the enemy in a site, at a period, and in a form which was least expected. The special advantages of each of the methods of systemic treatment, now in common use, we must reserve for separate consideration. Meanwhile, taking it for granted that the constitutional management is attended to, we will consider the treatment of the local affections.

During the early stage of the disease, while nyctaleptic pains, febrile symptoms, and chloro-anæmia exist, the hot-air, vapour, or Turkish bath will be found very advantageous in determining cutaneous congestion, and hurrying on the eruptive symptoms ; relieving thereby internal organs—more particularly the blood-forming glands, which appear to be embarrassed at this stage of the disease. The effect of warm-bathing is therefore advantageous in a threefold manner—1. By promoting cleanliness and free transpiration. 2. By hurrying on the cutaneous evolution. 3. By relieving the early febricular symptoms. These baths, if properly conducted, have no tendency to weaken the patient, or to make him susceptible of cold. To secure him from these risks—which lead many to employ warm-bathing with great distrust in its advantages—certain precautions should be taken. The bath should not be too hot, nor continued for too long a time ; it should be taken in the evening, and not too soon after a meal ; two baths in the week are sufficient ; and cold bathing in the morning need not be interrupted. There is seldom any advantage in medicating the bath, especially if mere glutinous substances or detergents are what is designed to be employed. Of course, mercurials soluble in water, iodine, or bromine, do act, and that very powerfully ; while certain salines may produce some further effect than would reside in water alone—especially the natural thermal saline springs.

When eruptive affections appear upon the face, and are of a non-ulcerative type, a lotion containing corrosive sublimate will often serve to relieve the patient from what he feels to be a plague mark. For a like purpose mercurial and iodine ointments are in common use, and act

powerfully in aborting the progress of the papular and scaly eruptions more particularly. When vesicles or blebs appear, or fissures or cracks complicate the surface of the eruption, the solution of nitrate of silver will in most instances relieve the irritation, and protect and harden the surface, better than any oily or greasy substance. In some cases calomel and starch powder, dusted over the surface, desiccates and protects the tender and exposed skin. Where ulceration exists, various lotions may be employed; containing the sulphate of copper or zinc; the nitrate of silver; the chlorinated soda; the permanganate of potash; the tartarized iron; or iodine in solution. In many cases the black or yellow wash will be found more successful. The selection and strength of the lotion must be regulated by the condition of the surface, and the special circumstances of the case. Before, however, applying it, the crusts should all be carefully removed by means of a bread and water or bread and milk poultice. The lotion is applied by means of lint, soaked in the solution and covered in with gutta percha. Sometimes ointments containing a stimulating mercurial will be found more efficient than any other medicament. These are applied once or twice in the twenty-four hours; and to prevent the lard with which they are made from accreting and becoming rancid, it is always well to cleanse the whole surface by means of a weak alkaline lotion once at least in the course of the day.

Secondary Affections of the Appendages of the Skin.

Alopecia—Falling out of the hair. This occurs in three different forms, and belongs to different stages in the syphilitic infection.

These forms are, 1. *Defluvium Capilli*—thinning of the hair, not only of the scalp, but of the eyebrows, eyelashes, beard, whiskers, and generally over the surface. This commences during the early stage of the syphilitic infection, before almost any eruption has appeared; but may continue for a considerable period during the first year of the syphilitic disease. The symptoms which attend its commencement are chloro-anæmia, febrile derangement, enlargement of the cervical ganglia, nocturnal headach, and usually some degree of exanthematous redness of the surface, with congestion of the fauces. The degree of shedding of the hair varies much; in some cases, coming out in handfuls, and giving the patient a most singular appearance; in others so slightly, as not to attract the attention of the patient till discovered by the surgeon, who, drawing a lock of hair through his fingers, finds that it comes away in quantity and with unusual facility.

This early form of alopecia, however complete may be the shedding of the hair, does not entail permanent baldness; the hair bulbs remaining intact, the growth is reproduced. We cannot, however, arrest the falling out of the hair; as, before it begins to manifest itself, the hair has already lost its attachment and must necessarily be exfoliated. The constitutional treatment of syphilis is all that is requisite for this form of alopecia. Should, however, a scaly eruption, attended with dandruff, accompany the shedding of the hair, a borax and rosemary lotion, or aromatic spirit of ammonia diluted with water, or infusion of rosemary, may be employed as a detergent. All stimulating applications should

be discouraged ; perfumed oil even tending to increase the risk of a pustular eruption becoming developed on the scalp. Shaving the head, which is so commonly recommended and practised, is not of the very slightest advantage ; except that the wig which it necessitates serves to conceal the thinness of the hairy covering.

2. *Alopecia proper*.—This form of falling out of the hair takes place either in large patches or sparsely, in those parts where the pustular and tubercular forms of eruption have occurred, followed by ulceration involving the hair bulbs in the destructive process. In this case, a white, perfectly bald patch is left, and remains permanently devoid of hair, admitting of no remedial treatment except that which is calculated to arrest the progress of the pustular or tubercular eruption on which it depends.

3. *Calvities* implies complete baldness of the whole surface ; the skin assuming the glossy smoothness of ivory, from the disappearance of every vestige of hair, or even down, from its surface. This form is very rarely seen at the present day. When it occurs it accompanies the advanced period of the syphilitic infection, and is always incurable.

Syphilitic onychia presents two forms ; one accompanying the squamous eruption, and producing a nail thickened, furrowed, and sometimes distorted from its normal axis ; the other commonly called *onychia maligna*, and usually accompanying the pustular crustaceous eruptions upon the surface. Here the nail is shed ; and in its place, a thickened, curdy, or cuticular formation is developed from the ulcerating matrix and surface naturally covered by the nail.

In the *first* form, painting the extremity of the finger with iodine will usually restore normal development of the part. In the *second*, nitrate of silver in solution, of the strength of forty grains to the ounce of water, may advantageously be painted from day to day over the raw tender surface and the site of the matrix ; the part being wrapped, after each application, in cotton wool or dry lint. In obstinate cases, a blister will produce a more speedy change for the better in the condition of the part ; after which a poultice, and then a solution of sulphate of copper, or of the permanganate of potash—or the red lotion—may be employed to hasten healthy granulation and healing. Diday recommends in cases of *onychia*, the use of an india-rubber finger stool filled with a mixture of gum and mercurial plaster, with olive oil in such quantity as to render it soft. In cases which resist this simpler treatment, and where the irritation is great, the nail, if it still remains, should be removed, and the matrix and ulcerated surface touched with caustic potash. In the first class, the constitutional treatment appropriate to secondary syphilis should be adopted ; in the second, that for the transitional symptoms is to be employed.

Secondary Syphilitic affections of Mucous Membrane.

These, like the cutaneous affections, present different appearances according to the stage of advancement in the syphilitic infection ; and, in a general way, they correspond to the eruptive affections upon the skin, and seem merely to be modifications of these, produced by the nature of the surface upon which they appear, and the circumstances in

which they occur. Thus the roseolar and erythematous eruptions on the skin, are accompanied by the erythematous or congestive affections of mucous surfaces; the papular of the skin, with the papular excoriations of mucous membranes; the scaly affections of the cutaneous, with the greyish elevated pellicle of the mucous surfaces; the pustulo-crustaceous of the integument, with the "excavated ulcer" of the mucous surface of the throat, as described by Mr. Hunter.

These eruptive affections of the mucous membrane are commonly described as affecting the throat; but, in reality, all mucous membranes may suffer more or less; the conjunctival certainly less commonly than any other. The cause, in all probability, of the affections of the throat having been more frequently observed than those of the vagina or interior of the prepuce, is merely that this part is more susceptible of irritation than the others. Hot fluids, pungent ingesta, smoking, exposure to cold, and gastric disorder, all tending very markedly to determine simple inflammatory change to that part—we may reasonably presume that they have a similar influence upon these specific inflammatory affections.

Forms of Syphilitic Affections of Mucous Membrane.

1. *Erythematous, or Roseolar Sore Throat*, is a very early and evanescent symptom of the syphilitic infection. As it frequently appears before the analogous cutaneous eruption has become distinctly developed, it is very liable to be overlooked, or, at all events, to have its syphilitic nature not recognised. The redness is usually of a dark rosy tint, and may be attended with some slight œdema of the bucco-pharyngeal mucous membrane. The congested portion may be generally diffused, or circumscribed in patches. This affection may also be recognised upon the surface of the glans penis, or on the interior of the prepuce. The redness may either disappear, and the membrane be restored to its normal condition, or it may be transformed into the third form of syphilitic affection of mucous tissue, viz., the condylomatous condition.

2. *The Superficial Papular Erosion* occurs more frequently upon the surface of the vagina and cervix-uteri than elsewhere. It may, however, appear upon the balano-preputial mucous membrane. In its early stage, it resembles eczema closely. The surface of the papule, about the size of a pin-head, is slightly raised above the general level of surrounding parts; the epithelial layer then desquamates, leaving the summit of the papule of a brighter colour than the rest of the part. Unlike eczema, there is usually no itchiness, and no generally inflamed base on which the papules are set; while it usually accompanies the papular or early tubercular eruption upon the cutaneous surface.

3. *The White, Patchy, or Condylomatous Affection of Mucous Membranes*.—The ulcerous excoriations of Mr. Hunter; Sibbens (?). The Yaws?

This condition may appear either as a result of the pre-existence of either of the two previously described forms of affection of the mucous membrane, or without any previous manifestation upon the part. Its proper period for development is during the occurrence of squamous or early tubercular eruptions upon the general surface; of which, in

fact, it is a mere modification. Thus, a scaly patch at the angle of the mouth may have its outline completed by a white patch at the commissure of the lips. These patches, furthermore, present a more or less regularly rounded, or oval form, and are slightly elevated above the surrounding parts. They feel, when manipulated, firmer than the surrounding sound textures. Their surface presents a milky white aspect. They occur upon the tongue, fauces, cheeks, and commissure of the lips; upon the vulva, vagina, cervix uteri (simulating granular cervix), upon the orifice of the anus, the commissure of the eyelids, and tarsal interior aspect of the margins. When they occur in the throat, they give considerable pain in deglutition, with uneasiness in the region of the velum palati, posterior nares, and upper part of the pharynx—attended in some cases with a nasal voice, and in children with a “snuffling” breathing and cry. When the larynx is affected, aphonia is produced; and when the Eustachian tube is interfered with, there is more or less deafness. The tonsillar surface and crypts sometimes become so turgid and enlarged from this affection, as almost to occupy the isthmus of the fauces.

Diagnosis.—*Sibbens*, an affection common in some of the country districts in Scotland, has rightly or wrongly been supposed to be this condylomatous condition of the mouth and fauces. In some instances, the affections described under the name of sibbens have really been of this kind; in others, they have as unquestionably been nothing but aphthous stomatitis. The peculiarity, however, of those cases which have been denominated sibbens, has been the supposed direct method by which the disease has been communicated; as, *e.g.*, from kissing, or drinking out of the same cup, or from smoking the same pipe. The best narration of cases of this affection under the name of sibbens, is that given by Mr. Wills, a surgeon at Cumnock, in Ayrshire, in the *Edinburgh Monthly Journal* for April 1844. And an attentive perusal of the cases given by that gentleman will, I think, satisfy the reader that this affection which he describes, was neither more nor less than secondary syphilis, resulting from an indurated chancre which had been communicated in the ordinary way.

In the April number of the *Edinburgh Journal of Medical Science* for 1826, Dr. Hibbert attempts to prove that the yaws of the West Indies and the sibbens of Scotland are the same disease; and both identical with *Framboesia*. He also attempts to establish an identity between them and the *Morbus Gallicus* of the fifteenth century; which, however, he believes was not syphilis. The great distinction between the yaws and any of the syphilitic affections, is the tendency of the eruptions to terminate in the formation of a peculiar fungating frambæsi-form fungus.

From *Aphthous Stomatitis* the condylomatous affection of the mucous membrane can be distinguished, by the multiplicity of the small patches of the former, by their consisting of a dull white pellicular structure, which peels off and leaves an excoriated tender surface beneath, and by the buccal inflammatory affection, with gastric derangement and foul breath which uniformly accompany the aphthous disease.

Mercurial Stomatitis can readily be recognised by the spongy tumid gums, loose teeth, and swollen tongue, which, if ulcerated, has the raw

surface situated either marginally or inferiorly, usually produced by the pressure of the teeth, and presenting a yellowish sloughing hue.

When an apparently condylomatous throat causes any doubt as to its nature, which is not set at rest by examining the cervical ganglia, and the more accessible cutaneous surfaces, the verge of the anus should be inspected—as condylomata are likely to be found there; and the condition of the inguinal glands should also be determined.

4. *Ulcerative affections of the mucous membrane—Excavated ulcer* (Hunter). This is analogous to, and usually accompanies the pustulo-crustaceous eruptions upon the skin. The ulcer presents a yellowish sloughing surface, with a red irritable margin, and tends to destroy the superficial part of the mucous membrane—not the submucous tissues, as is the case with the tertiary affections of the same parts. This ulcerative affection may sometimes in cachectic patients become phagedænic.

Treatment.—The earlier and more superficial affections require but little local treatment. Warm water, an astringent lotion, or chlorate of potash gargle, the occasional application of nitrate of silver in solution, or in the solid form, with a mustard poultice externally, and the use of guaiacum in ten grain doses taken internally, will usually prove amply sufficient.

The condylomatous affection generally requires the application to the surface, every second or third day, of the solid nitrate of silver, or sulphate of copper. By some, mercurial gargles or weak lotions, applied by means of a hair pencil, are preferred. The constitutional treatment of secondary syphilis must be at the same time carried on.

In the ulcerative affection, the nitrate of silver and sulphate of copper are sometimes not sufficiently powerful alteratives. The nitric acid may then be carefully applied, taking care to avoid dropping or diffusion of it on sound tissues. In phagedænic cases, a solution of the permanganate of potash, or of the tartarised iron, should be employed as a gargle. By some, the hydrochloric acid in infusion of cinchona is greatly trusted. In all cases, iron tonics, good food, cod-liver oil, and stimulants, will usually be found essential elements in successful treatment.

Syphilitic affections of the Eye we have already considered in treating of the diseases of that organ.

1. Indurated chancre may form upon the lids, or at the commissure; this, however, is a very rare lesion.

2. Ophthalmia tarsi of the scaly, pustular, or tubercular type, may supervene.

3. Keratitis, iritis, choroiditis, and retinitis may occur.

4. There may be affections of the nerves and muscles of the eyeball.

The symptoms and treatment of all these maladies, we have already considered.

Syphilitic affections of the teeth we have also already alluded to; forming as they do the key to many morbid states, which hitherto have been classified as of strumous or scrofulous origin.

Tertiary Syphilis.

The lesions included in this part of the syphilitic constitutional

symptoms consist of affections of the subcutaneous and submucous areolar tissue (gummata)—of the testicles (syphilitic sarcocele)—of the fibrous and osseous tissues (periostitis, osteitis, syphilitic necrosis)—of muscles and tendons—and, generally, of internal organs.

Along with these affections of deep-seated texture, we frequently find combined some of the transitional symptoms—such as the later pustulo-crustaceous eruptions, and ulcerating tubercles.

The period of development of the tertiary symptoms rarely commences before the sixth month after infection. It is capable, however, of indefinite prolongation; and symptoms pertaining to this stage of the syphilitic infection may appear after the lapse of many years; more especially when any cause of general debility has come into action to determine their evolution. Ricord states, as a farther characteristic of all tertiary affections, that they are incapable of hereditary transmission as such, and that they cannot be communicated by inoculation from one individual to another. By some, however, hereditary transmission, in the form of scrofuloid affections, is maintained; while, at the present day, as the whole subject of the communication of syphilitic infection by the inoculation of secretions rendered by the constitutional products of the disease is matter of debate, it seems better not to claim such negative properties as distinctive of tertiary affections.

Virchow and Von Baerensprung would exclude from their classification of constitutional symptoms all consideration of mere situation, and base their distinction between secondary and tertiary syphilis upon the nature of the product resulting from the pathological changes in the different lesions—the tertiary being characterized by the formation of a tubercular product in the texture or organ affected. Whatever difficulty may be felt in reducing all the facts connected with the evolution of constitutional syphilis to the outlines of a rigid classification, the tertiary symptoms may assuredly, in the words of Mr. Hunter, be said to consist of affections so dissimilar from the secondary, as almost to constitute another disease.

Affections of the Subcutaneous or Submucous Areolar Tissue—Gummata.—These have three periods of progress, which require to be distinguished:—

1. They exist as dense ovoid or nut-like nodules, varying in size from a pea to an almond—hard as cartilage, movable below the skin, gliding like a fibrous tumour beneath the fingers, and usually unattended with pain.

2. They become softened, larger, and adherent to the integument or mucous membrane, which assumes a dull red or dusky violaceous tint, and is elevated.

3. The centre of the swelling fluctuates, thinning and pointing of the skin ensues, and a central aperture forms by ulceration, from which a gummy tenacious matter escapes. Gradually a yellow deep sloughy-looking ulcer is disclosed, with undermined overhanging margins. The textures around usually become thickened and brawny, and when several such “areolar tissue ulcers” exist grouped together (as is usually the case), a probe introduced at one opening may pass towards the others; but not so readily as in the common scrofulous ulcer. When cicatrization takes place, the thickening is removed, while the skin around assumes a

more normal tint, and is adherent to the tissues below. The margin of each of the sores then becomes continuous with the granulation, with which the surface of the ulcer is now covered; and when healing is complete, a depressed cicatrix, at first of a dark red or livid colour, occupies the site of the sore; but this ultimately, when sound, becomes of a dull white colour.

These *gummata* may occur upon any part of the body; the lower extremities, the extensor aspect of joints, the front of the thigh and the scrotum, are, however, their most usual sites. They also form in the substance of the tongue, where they are liable to be mistaken for cancer of that organ. In the soft palate and mucous membrane of the pharynx and nares, they occasion at times a very extensive and almost phagedænic ulcerative destruction of the textures. Affecting the orifice of the Eustachian tube, they produce more or less permanent deafness. Involving the pharynx, œsophagus, rectum, or vagina, stricture of these canals may be produced by the cicatricial contraction. Implicating the larynx, aphonia, œdema glottidis, necrosis and exfoliation of the cartilage, and permanent contraction of the organ of voice, may be expected to occur. Similar nodules to those which constitute the early stage of these gummy tumours and “areolar tissue ulcers,” are coetaneously met with in internal organs, but are supposed by some not to have the same tendency to undergo softening changes as when superficially situated. By others again, all tertiary affections of periosteum, bones, nerves, and internal organs, are believed to be precisely analogous in morbid anatomy and pathology of formation to these “tertiary nodules” or “tubercles”—modified as to symptoms and results only by the site and nature of the tissue in which they occur.

Syphilitic Affections of Bones present three types.—1. The hard syphilitic node, due to limited thickening and hyperplastic enlargement of its osseous structure; existing both upon the surface beneath the periosteum, and also internally towards the medullary canal.

2. The soft fluctuating syphilitic node. Here, peripherally, there is hyperplastic ossific product. Centrally, by conversion of the dense laminated tissue of bone into a porous honey-combed structure, due to absorption of the calcareous constituents with coincident multiplication of the cell structures, medullary tissue results. This, in turn, by further cell multiplication and fatty degeneration, becomes fluescent, forming an elastic fluctuating collection beneath the periosteum; which resembles in its early stage a chronic abscess. In some cases death of some portion of the osseous tissue accompanies this change in the nutrition of its constituents, and an exfoliation is thus formed (Syphilitic Necrosis).

3. General enlargement of the shafts of one or more of the long bones; the tissue both externally and internally becoming condensed, with a nodular or stalactitic surface.

These three forms of syphilitic affections of bone, as regards both the period and the frequency of their appearance, occur in the order described.

Similar affections to the *gummata* are met with in muscles, tendons, and fibrous tissues, in the synovial membranes, and in internal organs; and the testis, liver, lungs, brain, and muscular substance of the heart,

may be mentioned, as affording illustrations of the varied situations in which these nodules may be developed.

The syphilitic cachexia is, indeed, sometimes undoubtedly due to the implication of internal organs in disease, either directly the result of tertiary syphilitic change, or induced by the condition of weakness to which the system has been brought by the progress of the syphilitic infection; and in some cases of advanced syphilis, the cachectic condition is accompanied, if not induced, by an amyloid degeneration of internal organs and their bloodvessels.

Treatment of Tertiary Syphilitic Affections.—The management of these diseased conditions, as of those appertaining to the secondary period, must be chiefly constitutional. Reserving for a little the consideration of that part of the treatment, we may here state, in general terms, that the local management of the tertiary syphilitic affections resolves itself into the employment of stimulating measures calculated to excite a textural change of a more normal kind. For this purpose, repeated blistering is well suited to the *gummata* of the subcutaneous tissues in all their stages. In the early period, absorption may be induced, or suppuration hurried on. In the ulcerating stage, the neighbouring condensation and thickening are absorbed, and the yellowish slough-like surface is transformed into a healthy granulating one. Should they resist this treatment, caustic potash should be applied to the sloughing-looking surface, and to the areolar tissue beneath the undermined skin. When the gummata are in their early nodular, or tubercular stage, the gum and mercurial plaster, or the use of tincture of iodine as a pigment, will sometimes suffice when the patient either cannot or will not submit to the use of blisters. Excision of the nodules should on no account be practised. In the case of tertiary affections of the submucous tissues, stimulation of the surface should be effected by means of the solid nitrate of silver; or, in the open stage, this caustic, or nitric acid, may be applied to the surface of the sore—the rate of ulcerative progress directing the choice of the agent.

In the early tertiary affections of bones, blistering of the surface affords very great relief, especially when pain is severe. In the soft fluctuating node, it is also better suited to every stage of the case than any other treatment. But in the general enlargement of the shaft of a long bone, accompanying the advanced period of the syphilitic affection, it is almost inert—as in fact is every other kind of cure.

The gum and mercurial plaster is also of great service in the early affection of the osseous system.

When internal organs are involved external stimulation proves usually of no great efficacy, and contrasts very unfavourably, in this respect, as compared with the satisfactory progress which usually attends upon its use in the case of syphilitic affection of the testicle. The symptoms yield, however, in most instances, except in an extremely shattered patient, to the use of constitutional remedies.

The Constitutional Treatment of Syphilis.

In considering this subject it is necessary to bear in mind the dis-

inction which we have drawn between the indurated chancre and all other sores upon the genitals, else a constant confusion will be produced in reconciling our statements with the accounts of the older authors, or even with the writings upon this subject of no more distant date than thirty years ago. Till within comparatively a recent period, mercury was considered a specific—indispensable as well as infallible—for the venereal disease in all its forms. We have seen that in the non-specific diseases—gonorrhœa, and its consequences—warts, herpes eczema—and in the soft non-infecting chancre—not only is mercury useless, but even injurious, both to the constitution and to the local disease. But, excluding these affections, its influence upon the syphilitic diathesis has been very variously estimated. By the old school of practitioners, it was believed that mercury possessed a specific and antagonistic influence upon the virus ; that the two poisons meeting in the circulation, the mercury, if only of sufficient quantity, exercised a destructive influence on its antagonist. These authors were of opinion that their favourite mineral acted in one of two ways. 1. That it united with the poison chemically, and decomposed it. 2. That it carried it out of the constitution by evacuation. With such a theoretical explanation of its action, it is obvious that the influence of the remedy would be entirely in proportion to the quantity given of the mineral. Mercury accordingly was pushed in practice to profuse salivation ; either in the belief that such was necessary for satisfactory elimination, or because this was regarded as the only sure sign that the mineral had been sufficiently introduced into the system, to exert its chemical action upon the poison concealed in the tissues of the body. The effects of the mercury were therefore measured, not by the disappearance or improvement in the manifest symptoms, but by the number of pounds of saliva which were spat in twenty-four hours ; while this state of poisoning was to be continued for “about six and thirty days,” and “a small dose of mercury must after this be continued for six and thirty days more, to keep up a gentle salivation.” Young gentlemen, in such circumstances, could not undergo treatment at home ; and houses for the purpose were therefore provided, where the mercurial courses might be duly performed ; and where the patients might remain until so far restored as to be fit to return to their business and homes. In hospitals, again, the “foul wards” might well receive their name. The stench and filth of such resorts of poverty and wretchedness, where many patients, all salivated, with loose teeth, swollen and ulcerated tongues, and an insupportably fœtid breath, were crowded together, and where inunction, inhalation, and mercurial vapour baths, were being constantly carried on, may be better imagined than described. It need be no wonder that patients died suddenly after undergoing such treatment (?) It need be no wonder that constitutions were ruined, and cachexia induced. It need be no wonder that our graveyards are rich in specimens of bones, such as no collector of the present day can obtain in any dissecting room. It need be no wonder that such a reign of mercury was in all respects most disastrous. Nor can it be a matter of surprise, that many preferred death to such a mode of cure. The wonder is, that Ulric de Hutten, after eleven such salivations, was left with sufficient bodily and mental activity to become the zealous apostle of an anti-mercurial treatment.

While such mercurial mismanagment continued to be plied with a blind, empirical, and desperate profusion, by the majority of practitioners, there were in every age others who became alive to the folly and danger of all such indiscriminate mercurialization, and even recognised that this agent did not possess such potent effects as to entitle it to the name of either a specific or an antidote. Various modifications, both in theory and practice, accordingly, came to be introduced even by those who implicitly relied on mercury, and mercury alone, in the treatment of syphilis. Mr. Hunter, for example, long ago stated, that while mercurials possessed the power of preventing the "venereal disposition," they had a much less certain influence upon "the disposition" when once formed. By this he meant to signify that, while syphilitic symptoms appeared in a minority of cases where mercury was employed in the treatment of the chancre, its administration in the case of secondary symptoms was found to be far less certain as a preventive of further recurrence of the disease. While there can be no doubt of the truth of this sagacious observation, the explanation of the fact is somewhat different from what he imagined. For, since in the term chancre—as the term was employed by him—was included both the soft and indurated sore—the former of which is, to the latter, in point of frequency, as three to one—as a matter of course, in the majority of cases treated by mercurials, no secondary symptoms of any kind occurred. This immunity, however, was not due to the treatment, but to the original non-infecting nature of the chancre. The important practical bearing of the observation, nevertheless, consists in the proof which it affords, that, with all his belief in the employment of mercury, Mr. Hunter still found it in practice variable in its effects on the constitutional disease, and uncertain as affording a promise for the future—after its administration even in much larger doses than are now-a-days employed—of anything like immunity against re-appearance of the disease. To Mr. Rose, Dr. Hennen, and Dr. John Thomson, we are indebted for further practical progress in these therapeutics. The remarks of Mr. Hunter, just quoted, had done much to make the mercurial treatment of all sores situated upon the genitals the rule, with the object of preventing the formation of the syphilitic diathesis or "disposition," as he called it. These gentlemen proved, by extensive observations made in military hospitals, that not only did sores upon the genitals heal without the use of mercury, but that, upon the whole, they healed more rapidly than when mercury was administered; while, furthermore, secondary symptoms appeared in but a small minority of the cases, and in these not more frequently than when mercury had been employed as a preventive to the disposition. But with our present knowledge of the characters of the infecting chancre, and the necessary occurrence of syphilis as a consequence of its existence, we see a very different explanation of the results of the non-mercurial treatment advocated by those gentlemen; we have, in fact, in their experience, an excellent illustration of a mixed mass of soft and indurated chancres spontaneously developing their distinctive characteristics.

In considering, therefore, the treatment of syphilis by mercury, we wish distinctly to guard ourselves against misapprehension; explaining that by syphilis we mean the systemic disease, which, commencing with

the indurated chancre, is followed by a train of secondary and tertiary symptoms more or less developed and prolonged ; and that by mercurial treatment we do not signify mercurial poisoning, effected by the continuous salivation of a patient, as was formerly practised.

The mercurial treatment of syphilis may be begun at different periods of the disease. By some it is employed at the commencement ; so soon, in fact, as the characters of the indurated chancre render the nature of the disease obvious. By others, its use is reserved for the secondary symptoms ; in the initial sore, limiting its employment to those cases where the induration is so great as to retard the progress towards a sound cicatrization, and where the cicatrix, when formed, seems liable again to give way. By some, again, a selection of cases is made ; the squamous eruptions, the condylomata, and the affections of the eyeball, more particularly, being treated by mercurials. By all, its use is not prolonged beyond the secondary period ; except in obstinate tertiary cases where mercurials have not previously been employed.

M. Ricord strongly urges the commencement of the mercurial treatment so soon as the essential characters of the indurated chancre are recognised. He reasons thus in favour of this practice :—" With me the induration of the chancre is the commencement of the diathesis ; it is, in fact, the first secondary symptom ; there is no need, therefore, to wait for other painful, unseemly, and disagreeable symptoms, before we commence the use of a remedy which will prevent or modify their evolution." At the same time, Ricord urges that, as mercury is advantageous in the treatment of venereal affections only in the case of syphilis, that its use should not be commenced in doubtful cases, until such secondary symptoms appear as will secure the practitioner from the risk of error in his prognosis. For, if the sore be doubtful in its characters, and you make use of a remedy which, at the outset, certainly possesses a great modifying power upon the evolution of the syphilitic affection, you prevent both yourself and patient for a long time from being absolutely certain of what may eventuate in his future history. In such a case, at the end of six months, can you give the patient a *carte blanche* of good health, and allow him to consummate a marriage without anxiety as to its results ? If the patient had taken no mercury, he would certainly, by this time, have manifested unmistakeable signs of the nature of his disease ; but as mercury both tends to prevent the cutaneous evolution of the poison, and retards generally the manifestation of its results, you must remain in ignorance as to the ultimate issue, and at least feel doubtful whether the absence of constitutional symptoms is due to the treatment or to the original character of the sore.

By others, again, delay is recommended, until not only the indurated sore, and the concomitant bubo, but also the cutaneous eruption and other early symptoms, have begun to develop themselves, and make the diagnosis a matter of certainty. They also prefer it, because the cutaneous eruption affords a criterion by which the effects of treatment may be estimated, and the progress of the remedy made more obvious to the patient than could otherwise be the case. When, however, the induration is well marked, obstinately persistent, delaying the progress of healing in the sore, occluding the orifice of the urethra, preventing retraction

of the prepuce, situated upon the prolabium, or, in fact, existing under any peculiar circumstances which render speedy cicatrization with the restoration of the normal suppleness of the tissue desirable, then mercurial treatment may be commenced before the cutaneous manifestations display themselves. Also, when the febrile accession sets in with severity, when the chloro-anæmia is well marked and becoming worse instead of better under dietetic and other treatment—when cephalalgia is severe, and, by interfering with rest at night, is gradually enfeebling the patient—the mercurials should be had recourse to without further delay.

By the time the erythematous or roseolar eruption has made the nature of the disease unmistakeable, then the remedy should be regularly commenced.

In the case of the scaly, early tubercular, and condylomatous affections, and in the form of iritis which so commonly tends to occur in this period, mercurials are certainly more obviously advantageous than at any antecedent or later date. Their use has, therefore, been all but unanimously approved in such cases.

In administering mercurials in syphilis, the effect which we desire is something short of salivation. In fact, whenever the gums become tender the dose should be diminished in frequency or in quantity, so as to keep the system upon the verge of that condition without allowing it to be overstepped. Yet, while stopping short of the actually poisonous effects of mercury, we should not hold our hand in its administration at too early a stage. Till some degree of the physiological effect of a remedial agent has been attained, we cannot tell what dose of it is required in each special case. In using mercury, therefore, its effects must be tested; tentatively watching for any tenderness of the gums or foetor of the breath. The gums behind the incisor teeth in the upper jaw, and around the wisdom teeth in the lower, are the parts which usually first indicate that the desired limit has been reached. Having discovered the dose suited to the case under treatment, it is usually necessary, so long as the agent is continued, to test its effects from time to time; lest either the cumulative effect of the remedy requires that the dose should be diminished, or special idiosyncrasy demand a larger quantity than before. Should the safe limit be overstepped, the mercurial must be stopped, and means taken to prevent further buccal irritation from developing itself. Of these, saline purgatives, with the use thereafter of the chlorate of potash, will be found most satisfactory; and by some practitioners the prevention of salivation is presumed to be secured, by the administration of the chlorate along with the mercurials. As a general rule, the good effects of mercurial treatment are best observed in the affections which manifest themselves during the early evolution of the diathesis; while in the more advanced, which we have called transitional, commencing in fact in the suppurative eruptive affection, and usually merged insensibly into the tertiary, mercury alone will not be found to act so satisfactorily. Here iodide of potassium may be advantageously combined.

Form and Mode of Administering the Mercurials.—Mercury may be administered in the treatment of syphilis, either by the mouth, or by the cutaneous surface. By the former channel, which is the common one,

the remedy may be given in various different forms, simple or combined: the choice being directed by the rapidity of effect desired, the avoidance of gastro-intestinal irritation, the idiosyncrasies of the patient, and, to a certain extent, by the stage at which the disease has arrived.

In the latter plan of introducing the remedy into the system, two different modes may be adopted—inunction, and the vapour bath.

By most practitioners the administration of mercurials by the mouth, instead of by cutaneous absorption, is preferred; because by the former the desired degree of physiological effect is more certainly attained and regulated, and because the remedy can be continued with less trouble, less annoyance from filth, and with less obstruction to the every-day life of the patient. The common forms of mercurials in use are calomel, Plummer's pill, blue pill, mercurial ointment and soap pill, grey powder—the protoiodide, biniodide, and bichloride of mercury. These may either be administered alone, or in combination with each other, or with some tonic adjuvant; or with a corrigent, in the shape of opium, hyoscyamus, or belladonna, should griping or purging attend upon the use of the simple remedy. The blue pill, the protoiodide, or the bichloride, will usually, however, be preferred to any of the others, having less tendency to induce sudden salivation or disagreeable effects upon the system generally. In cases of severe nyctalopic pains, where rest has been denied for nights together—and in cases of iritis, choroiditis, or retinitis—calomel covered with a suitably corrigent quantity of opium or morphia will generally be selected. In young children, again, grey powder will be found more convenient, as it can be administered in articles of food without the knowledge of the patient.

The internal administration, it is usually acknowledged, should certainly be continued, if employed at all, until all the syphilitic symptoms upon the surface cease. Opinions differ, however, very much as to the length of time after that effect has been attained, during which the use of the remedy should be prolonged. By Ricord, who prefers the protoiodide of mercury, the dose of one grain every evening after food is at first taken. When this causes griping, a half-grain dose night and morning may be substituted; or an opiate is given with the pill at night. If at the end of the first week no physiological effects manifest themselves, the dose is increased; and thus the treatment is continued till the gums become tender. That point being attained, the effect is diminished if need be, or continued, but on no account permitted to increase. If sudden irritation of the gums or system is produced, the effects must be allowed to subside before the remedy is again commenced. He does not however discontinue the mercurial treatment, when all the cutaneous symptoms have disappeared; for this he believes exposes his patient to the return of other symptoms of the diathesis. Neither does he adopt the rule of Dupuytren, to continue the treatment for as much longer. He finds, so far as mercurial treatment is concerned, that the daily dose or doses which suffice to influence the symptoms, and to produce a gentle physiological effect after they have ceased, must be continued for six months. After this, the iodide of potassium, as a preventive to the more distant affections of the diathesis, should be employed for three months. And by means of such a practical standard

he finds, from his large clinical experience, that with slight modifications, to suit the various cases to which it is applied, the happiest results can be thus obtained in neutralizing the virus—in curing its existing, and in preventing its as yet undeveloped, manifestations. Such a rule is certainly more satisfactory than that of the late Mr. Colles, who inculcated the full administration of mercury for a few days after all hardness of the cicatrix had been removed, with moderate ptyalism kept up for a month afterwards.

Mercurials introduced by the Cutaneous Surface.—*Mercurial Inunction* consists in the employment of repeated frictions of the strong or weak “blue ointment” into those parts of the body where the skin is naturally soft, and inclined to absorb the remedy. In employing the mercurial inunction, it must be recollected, that although highly prized by the Germans, it is a dirty and inconvenient process; chiefly suited for cases where there is no urgency in the symptoms, and where the internal use of mercurials gives rise to much irritation. If the season can be chosen during which it is employed, spring or summer should be preferred; and a course of warm bathing should be employed as a preliminary. The frictions may be made either by the patient, or by an attendant; in the latter instance, the hands of the rubbers should be protected against the risk of mercurial absorption by means of bladders softened in oil. The strong mercurial ointment should be preferred, except when the skin is tender, and easily made irritable by the application—mercurial eczema, or a pustular eruption, tending to appear. The inner side of the thighs, the groins, the flanks, the anus, and the axillæ, are in turn the parts to which the inunction is usually applied. The frictions are best made at night, before the fire, after the patient has undressed for bed, the quantity of ointment varying from a scruple to a drachm; the parts are then covered with flannel during the night. In the morning, the remains of the ointment are removed by means of a warm bath and soap; after which the patient should lie in bed covered closely with blankets, and a warm drink may be given to produce perspiration. The patient should be confined to bed for half the day; and while the clothes and body linen are frequently changed, and ventilation provided for, the room should be kept warm. The diet must be of the very simplest kind; tobacco and all stimulants are forbidden. This process may require to be continued for forty days; but from twenty to thirty usually suffice (Sigmund). In this country, while inunction is frequently used with very satisfactory results, the confinement and restrictions mentioned as part of the treatment employed in Vienna, can rarely be enforced. A modification of the system, which is found very useful in children and infants, consists in the continuous application of blue ointment to the cutaneous surface, spread upon lint, and covered with flannel. In some special cases, the gum and mercurial plaster may be advantageously used, with the view of securing a double effect—in part on the system, and in part on some local lesion.

Mercurial Baths.—By some the effect of the warm bath in determining cutaneous action, is combined with the use of mercurials. 1. By the addition of a solution of the bichloride of mercury to the com-

mon warm bath. 2. By the use of the mercurial vapour bath. 3. By mercurial fume and the hot air bath (Lalouette, 1786).

The effect of these modes of procedure upon a cutaneous eruption is very marked, producing more rapid disappearance of it than mere internal use of the drug or inunction can effect. By some the bath alone is employed; by others, inhalation of mercurial fume is combined; or the internal administration of some form of the remedy is proceeded with at the same time. The combination of aqueous vapour with the mercurial fume and inhalation is what is commonly recommended at the present day. The apparatus for this purpose consists of a tripod-stand and spirit-lamp, supporting a marginal water-trough and a central mercury-plate—the latter a little larger than a crown-piece. The patient, in the nude state, sits upon a cane-bottomed chair, beneath which is the tripod stand; and the chair and his body, exclusive only of the head, are covered with a large Mackintosh cloak—or two or three ply of blankets. The vapour and mercurial fume rise together; and the surface of the body thus becomes bedewed with perspiration, watery vapour, and the condensed mercurial. The bath should be continued for a quarter of an hour or twenty minutes. During the progress of vaporization, on opening the cloak or coverings at the front of the neck the mercurial fume rises, and may be inhaled for about five minutes. This is useful when the effect is wished to be rapid; and especially so when the throat is affected with condylomatous ulceration. After the bath, the patient should sit quiet till the temperature begins to diminish; he then throws off the coverings, waits till the aqueous vapour has sufficiently dried to enable him to put on his night dress, and retires to bed. The surface should neither be rubbed nor dried after the bath. Various forms of mercurial may be employed for this purpose; but calomel should be preferred, as being both more certainly vaporizable and less irritating than any other form of the mineral. These baths may be taken either every night or less frequently, according to the condition and circumstances of the patient; the length of time recommended for their employment being—a month for treatment commenced during the early progress of the indurated sore; six weeks, for patients in whom the disease has attained to the secondary stage; and two months for patients suffering from tertiary affection. Mr. Livingston Parker recommends the use of the bath for two or three weeks after the primary disease with all induration of the cicatrix has disappeared, and thereafter that the patient should take a vapour bath once or twice a week.

By some the mercurial bath is scouted as an inefficient means of administering mercury; the mercurial effects being, they allege, very uncertain, as salivation can rarely be induced. By others it is thought equally powerless as a mercurial, the good effect being by them attributed to the aqueous vapour bath alone, as well as to the absence of all mercurial treatment.

The good effects of the employment of mercury, in one form or another, are sufficiently manifest in most cases; even when administered before the cutaneous symptoms manifest themselves. In ordinary conditions of spanæmia, accompanied with muscular weakness, languor, a sense of great mental depression, with sleepless nights and violent

neuralgic headache, the use of mercury would only aggravate the disease. In syphilis, on the contrary, as the use of the mercury is continued the patient becomes relieved from his depression, and grows light and buoyant in spirit; his debility ceases, his complexion and appetite return, and refreshing sleep is restored. If, however, the effect is pushed beyond this point, bad results follow. Depression of mind and strength, a weak irregular pulse, and loss of appetite, may set in.

From these considerations, it is contended that, while mercury and syphilis, and still more especially the whole mass of venereal affections, are no longer inseparable, it is yet to be admitted gratefully that this mineral is in not a few cases a most important and indispensable remedial agent; used, however, much more sparingly than in former times; and consequently, not only more efficient as a means of cure, but also less likely to peril the future durability and soundness of the frame.

Iodine and its compounds have long enjoyed a high reputation in the treatment of syphilitic affections. By some surgeons they have been regarded as equally potent for good, yet without the ill effects imputed to mercurials. By others again, iodine has been supposed to be of use only or mainly after mercurial treatment; but this party consists of two sections—the one regarding the remedy as solely applicable to the advanced or transitional and tertiary stages of the disease, the therapeutic effects of iodine being in direct ratio to the duration of the diathesis; while the other section regard it as producing good effects, mainly, if not altogether, in virtue of its supposed power of rendering soluble the mercury, which is supposed, by them, to lurk in the system; and thus to its power of hurrying mercurial excretion, they ascribe its virtue in restoring the general health.

In the early stage of the disease, while the sore exists, and in the interval between the commencement of the sore and the first appearance of the syphilitic eruptions, this remedy has little or no effect, either in the way of producing absorption of the induration of the chancre, or in delaying or modifying the appearance of the secondary symptoms; and the chloro-anæmia and cephalalgia are but slightly if at all influenced by it. In the more advanced anæmia or cachexia, on the other hand, which usually exists along with the gummata, and affections of the bones and periosteum, the preparations of iodine act like magic; and this effect is observed uniformly, whether mercurials have or have not been previously administered. While this is generally admitted, however, the preparations of iodine are by some considered incapable of themselves exterminating the tertiary affections and preventing a relapse, unless mercurials are given to assist them in this cleansing process.

In administering iodine, certain physiological effects of its use must be kept in mind as a standard to estimate its effects, and as a caution against continuing its use after a period when it is likely to do more harm than good. The first physiological effect is usually observed upon the mucous membrane of the nostrils, including the frontal sinus and antrum. The symptoms are those of acute or subacute coryza. By some, however, irritation of the fauces and bronchi, and even œdema glottidis, and gastro-intestinal irritation, have been ascribed to the use of this

remedy ; while subretinal serous accumulation, with dimness of vision, and even salivation, have been presumed to accompany the irritating effects of the medicine.

Cutaneous eruptions of an erythematous, papular, vesicular, or furuncular character, may be evolved in cases where iodine exerts an irritant influence upon the gastro-duodenal system ; and it can easily be supposed that a greater degree of like irritation deranging the hepatic function would suffice to produce the sensation of oppression in the head, tinnitus aurium, neuralgia, spasmodic twitching of the muscles, impaired voluntary motion, sluggishness of the intellect, followed by rapid emaciation, nervous palpitation, and a morbid craving for food, which has been supposed to be due to the proper physiological effects of the iodine carried to excess, and from which theory the term iodism has been derived.

The atrophied condition of the testes and mammæ, which has been alleged to occur as the result of prolonged iodic absorption in the treatment of syphilis, has always been discovered to be due not to the iodine, but to change in the nutrition of the part induced by the syphilitic alteration of texture ; so that when the adventitious product has been absorbed, the gland atrophied by pressure is found smaller than it was previous to the involvement.

In administering iodine, the substance may be given either in the form of simple solution, or combined with the iodides of potassium, sodium, or ammonium. The compound *Liq. Iodinii* of the *Edinburgh Pharmacopœia*, or the simple iodide of potassium may be prescribed. By some, again, the iodides of iron, or quinine, in the shape of pill or syrup, are preferred. The dose of the common iodides of potassium, sodium, or ammonium, may vary from three up to ten grains three times a day ; and to prevent decomposition into iodic acid, the remedy should be taken on an empty stomach. To obviate qualminess, or griping, some carminative, tonic, or stomachic, may be administered along with the drug.

Treatment of Syphilis by Chlorate of Potass.—This remedy has been as highly vaunted by some, as it has been held valueless by others, in the treatment of syphilis.

We have already seen that it possesses the inestimable virtue of relieving the patient from the effects of salivation, or even of preventing its access, when administered along with the mercurial. Its virtues in influencing the general syphilitic diathesis, however, have appeared to us to be of a very doubtful kind ; although, in the affections of the mouth and throat, when used as a gargle, as well as administered internally, it certainly affords very marked relief.

Treatment of Syphilis by Purgatives.—This has rarely been tried without the use of some so-called specific, or alterative remedy, complicating the results. When employed, sulphate of magnesia, Harrogate salts, natural saline springs, the phosphatic laxative, and the sulphate of soda, have been the remedies usually prescribed. Taken in a daily dose, largely diluted, in the morning before breakfast—and assisted by exercise, regulated diet, and the warm bath—a satisfactory issue has in many cases been attained ; even sulphur and cream of tartar at bed time, or a Seidlitz powder every morning, has, by many individuals who have under-

taken their own treatment, been found to afford satisfactory results—apparently assisting the tendency which the disease undoubtedly manifests, to wear itself out in process of time.

The Nitric and Hydrochloric Acids were long ago recommended in the treatment of this disease. The former, more particularly, was considered by Beddoes, Scott, Kellie, Rollo, Cruickshank, Hammick, Albers, Holst, and others, as specially efficacious. Mr. Pearson, however, gave the nitric acid a fair trial, and his testimony, as well as that of others, was decidedly against its trustworthiness. These remedies may be employed as lotions to the original sore, or to the cutaneous eruptions and affections of the mucous membranes, or as an addition to the warm bath; and when used internally, are given in water or any other suitable vehicle. In old and debilitated subjects, in syphilitic rheumatism, or in syphilis occurring in patients in whom there is well-marked atony of system from any cause—or as a tonic course of treatment after the use of mercurials or iodides has been carried too far—nitric or muriatic acid, both as an addition to tepid bathing and as an internal remedy, will be found attended with the best results.

Dietetic, Hygienic, and Tonic Treatment is, in syphilis as in all other diseases where mal-assimilation constitutes a marked feature of their progress, of the greatest importance. Any one uniform plan of dietetic treatment, in regard to syphilis, has rarely been employed; although “the Hunger Cure”* and “the dry treatment”† of the Arabians undoubtedly partake of this more nearly than any other. Neither does the affection in its different stages admit of any one constant system of dietetic regimen. For example, during the persistence of the sore a stimulating diet is usually unsuitable, while in the chloro-anæmic stage it is almost essential; in the febrile and eruptive periods the use of stimulating articles of food, and more particularly the free indulgence in alcoholic stimulants, is always injurious; while, again, in the later secondary and tertiary stages their regulated employment may be not only advisable, but even essential. When syphilis furthermore occurs in half-starved patients, or in those whose diet is meagre, and not suited to afford any surplus of blood-forming material to the system, the diathesis is in them usually attended by the most serious results; the transitional symptoms appear early, and a gravescent series of tertiary affections may be almost certainly anticipated. Dietetic treatment in syphilis, therefore, must be a most variable element; requiring much judgment to hold the mean between over-feeding and over-stimulation on the one hand, and too spare a dietary on the other. As a rule, anything which is calculated to induce hepatic derangement is likely to prove injurious;

* The Hunger Cure, *Cura famæ* of Sweden, Norway, and Denmark. This consists in keeping the patient upon a regimen for six weeks, composed of 5 ounces of roast meat, without gravy or condiment, 6 ounces of white bread soaked in water, in two or three portions, extract of conium 4–6 grains night and morning, with 2 pints of decoction of Sarza for drink.

† The Dry treatment of the Arabians is described by M. Benoit of Marseilles as consisting of entire abstinence from all ordinary articles of food; living meanwhile on biscuit, dried almonds, figs and raisins; taking for drink in the course of the day only a glass or two of decoction of Sarzaparilla; and swallowing a mercurial pill night and morning. (!)

and anything which depresses the system, debilitates the patient, destroys his sleep and takes away his appetite, should be avoided. But at the same time a general regulation of his life, simplicity in diet, abstinence from stimulants, and attention to the functions of the skin and bowels, with fresh air and such adjuncts as tend to keep up the spirits, and are calculated to prevent him from brooding over the condition of his health, may be regarded as essential to his satisfactory recovery. Tonics such as quinine, iron, and cod-liver oil, will frequently be resorted to, either singly or in combination with other drugs and remedial measures already mentioned. Zinc and arsenic may occasionally, though more rarely, exercise a beneficial influence upon the general health.

Vegetable Decoctions.—"Decoctions of the woods," so long ago as the sixteenth century, were introduced into this country as remedies for syphilis, and said to be attended by quite as great success as mercury, both as preventive and curative agents. The anti-syphilitic woods in common use were sarzaparilla, sassafras, guaiacum, and mezereon. In addition to these, the saponaria rumex, stillingia, dulcamara, conium, podophyllum, and various other vegetable substances, have since acquired a more or less extended fame as possessed of anti-syphilitic virtues.

The sarzaparilla, however, deserves most notice; as being still extensively employed both in this country and on the continent in the treatment of syphilis, and forming no unimportant part of the Zittman's decoction, and Lisbon diet drink (Decoc. Sarzæ. Comp.)*

The activity of this drug is, however, at best doubtful; at least in the form in which we meet with it in this country. Dr. Hancock, while he represents the sarza in the European market as practically useless, speaks of the Rio Negro sarzaparilla as affording an infusion which is emetic in large doses, while in less quantity it produces nausea, sweating, prostration, and torpor; and he asserts that, when taken regularly, it acts as a restorative and aphrodisiac, causing constitutional sores to heal, the body to become plump, the skin smooth, and the patient active. In Guiana it is regarded as a sovereign remedy for a species of strumous ulcer, and in all venereal complaints. In this city, it is looked upon in the light of a mere *placebo*; while in London and Dublin it is highly esteemed. Mr. Lawrence, for example, has a very high opinion of it in cases of phagedænic sores. The determination of its practical utility would be a matter of no small importance; as in one London hospital some years ago the annual expenditure for this item alone amounted to £1500.

* *Zittman's decoction* is of two kinds—the stronger and the weaker. The former is made as follows:—℞ Rad. Sarzaparillæ, ℥xii.; Aquæ, lb. xxiv.; m. coque per horas duas et adde Aluminis, ℥iss.; Hydrarg. Chloridi, ℥ss.; Antimonii Oxy. Sulphureti, ℥i.; m. coque ad $\frac{3}{4}$, et adde Fol. Sennæ, ℥iii.; Rad. Glycyrrhizæ, ℥iss.; Sem. anisi, ℥ss.; Infunde per horam et cola. Sig.—Half-a-pint to a pint morning and evening.

The weaker decoction is made as follows:—Capiat residuum decocti fortioris et adde Radicis Sarzaparillæ, ℥ii.; Aquæ, lbs. xxiv.; Coque per horas duas et adde Cort. Canellæ, Cort. Limonum, Sem. Cardamomi āā, ℥iii.; infunde per horam et cola. Sig.—A pint at intervals during the day. ;

Lisbon Diet Drink.—℞ Decoc. Sarzæ, ℥iv.; Lign. Sarzapar. concisi, Ligni Guaiaci versati, Glycyrrhizæ contusæ āā, ℥x.; Cort. Rad. Mezerei, ℥iv.; m. coque per partem horæ quartam. Sig.—One to two wine glassfuls for a dose.

The Guaiacum, in the form of powder, tincture, or decoction, is very useful in the early forms of syphilitic affections of the throat.

Syphilization.

In 1844 M. Auzias Turenne occupied himself with experiments upon the communicability of chancres to the lower animals. In the course of these experiments he found, that the first chancre was usually more rapidly developed, attained to a larger size, secreted more matter, was attended by a greater degree of irritation, and was more persistent than the second, the second again than the third, and so on, until a period was at length reached when the inoculation ceased altogether. This condition of apparent immunity to the further effects of the chancre poison was supposed to resemble the condition of system induced by vaccination, whereby an immunity to further vaccination is engendered. Hence, as all chancres were at that period supposed to be syphilitic in their nature, he called this condition of non-susceptibility to farther inoculation "syphilized," and the process by which it was attained "syphilization." In a communication to the French Academy in 1850, M. Auzias Turenne arrived at the following practical deductions from his experimental researches. 1. That syphilization may be employed in healthy persons as a preventive measure against the invasion of syphilis, precisely as vaccination is practised to protect the person from variola. 2. That syphilization is capable of curing persons suffering from constitutional syphilis. These results he stated he had tested upon man, and found them confirmed. The former of the propositions, as might have been expected, met with a violent opposition and an indignant rejection by the Academy, and with it the curative inoculation shared the same fate.

In the interval between 1850 and 1854, Sperino of Turin, Gamberini of Bologna, and Gulligo of Florence, published reports of cases of syphilis in which the curative process of syphilization was put to the test of an extended experimental investigation, with a result completely in its favour. These statements were received with suspicion, and discredited in this country until a comparatively recent period, when a further statement was made in favour of this procedure by Dr. William Boeck, one of the professors in the University of Christiania. This was contained in a paper communicated to the Edinburgh Medico-Chirurgical Society on March 3, 1858. Notices, however, of Boeck's, Malmsten's, Carlsson's, Stenberg's, Faye's, and Daniellssen's experiments, had previously reached this country from eye-witnesses of their practice, who had communicated their observations to the Edinburgh Med. Journal, Dublin Quarterly, British and Foreign Med. Chirurg. Review, and to the Medical Times and Gazette.

In 1851 Professor Boeck was travelling in the north of Italy, and heard much of the treatment of syphilis by syphilization, which had for the first time been put in practice on a large scale by Sperino, the surgeon-in-chief to the Syphilicome or venereal hospital of Turin. Returning home, Boeck resolved to try this process, as a long experience had convinced him of the uncertainty of the plans of treatment usually

employed against syphilis. In October 1852 he made his first essays. In March 1858 he had already syphilized no less than two hundred patients.* And in his great work,† published in 1862, he states that his experience of the effects of syphilization extends over 252 cases, in which no mercurial treatment had previously been employed.

Professor Boeck's directions for the employment of syphilization are as follows:—"I take the virus of an indurated chancre contracted in coitu, or of a pustule or artificial ulcer resulting in an individual who is being syphilized. I make the first inoculations upon the side of the trunk—three upon each side. After three days have elapsed, I make three more inoculations, employing for this purpose the matter from the last pustules. I continue in this way to inoculate the sides every three days, always employing for this purpose the matter of the last pustules, till I reach a point when a negative result is attained. Then I begin to inoculate the two arms, and I continue the inoculation in the same way until the matter here, too, ceases to produce any effect. Having reached this point, I take matter from another patient, and I inoculate the sides of the arms in both parts at once, and I continue with the new matter precisely in the same way as with the first, till it, too, ceases to act. When the condition of immunity on the arms and sides has been reached with the second matter, I begin the inoculations upon the thighs, and I continue precisely as already described till here, too, immunity is reached. On the three parts mentioned I then make further inoculations with matter obtained from other patients, till no matter which I can obtain produces any effect whatever." Inoculating in this way, Dr. Boeck recommends that the virus from the indurated chancre should be employed; believing that the virus of the soft and indurated chancres are virtually the same, but that the effect of the virus is more intense in the one than in the other. As the effects begin to diminish, he employs a more and more intense form of virus, using it then without any fear of inducing phagedæna. The site for the introduction of the matter is of importance; the lateral aspects of the chest and abdomen being best suited for the beginning of the process, as sores situated there have less irritability attending on them than those placed elsewhere—except, indeed, upon the face—chancres there being small, attended with but slight irritability, and tending sooner to cicatrize than in any other locality. The multiplication of punctures at each inoculation is unnecessary; one, two, three, or four may be made to prevent the risk of failure—not from exhaustion of the virus, but from inadvertence in practising this little operation. In making multiple punctures, they should not be placed too close to each other, lest they coalesce and form a painful ulcer, which may become phagedænic. The operation should furthermore be practised with scrupulous regularity; as, if performed too often or too seldom, either the period of complete immunity may be reached before the eruptions have disappeared, or the process may be indefinitely protracted—the sores formed being larger, more painful, and more liable to become phagedænic than when the process is conducted with precision. The

* Edinburgh Medical Journal, April 1858, p. 913.

† *Récherches sur la syphilis appuyées de tableaux de statistique tirés des archives des Hopitaux de Christiania*, par W. Boeck, 1862.

first inoculated spots should be covered with a strip of adhesive plaster, until the pustules form, and the second inoculation is required. After this, either water-dressing or oxide of zinc ointment should be employed to prevent the formation of crusts, and to diminish the degree of irritation which is otherwise sure to be produced. The effects, when regularly conducted, are so mild, that the process may be employed in children of tender age in the treatment of hereditary syphilis.

While this syphilization-treatment is continued, the diet is nourishing and generous ; but no alcoholic stimulants or tobacco are allowed. The effects of the process are noticeable in the gradual disappearance of the existing eruption without any other manifesting itself, in the amendment of health and strength remarked by the patients, and in the improvement of the complexion and increase in weight which are observed to occur. When the patient has previously been treated by means of mercurials, the inoculation has sometimes been found to fail until a preliminary course of iodide of potassium has been employed ; and in these cases, too, the period required for the treatment is usually longer, and the risk of relapse greater. The average time which this process occupies is from five or six, to seven or eight months ; and after this, should any relapse of the constitutional symptoms occur, repetition of the inoculation should at once be commenced.

With reference to the selection of matter for the commencement of the process of syphilization, Professor Boeck states that at first it was obtained from a soft chancre, and therefore admitted of inoculation being practised through a long series of generations, thus occupying a long period before the condition of immunity was obtained. Subsequently, however, Dr. Boeck has employed matter obtained from an indurated (?) chancre, which admits of inoculation through a much smaller number of generations. By its use he states that he has found the process rendered very much shorter ; the symptoms disappearing much more rapidly, and the condition of immunity being reached at a much earlier period.*

As to the satisfactory results which, according to Dr. Boeck's statement, issue from this method of treatment, we take no objection ; having, in fact, seen the salutary effects, described by Professor Boeck, to accrue from its employment, when no other curative agency interfered with the accuracy of the experiment ; and when the symptoms—the indurated chancre, the inguinal enlargement, the early constitutional changes, and the eruption upon the skin—were of so well marked a character as to make indubitable the effects of treatment in removing the existing symptoms, preventing the occurrence of others, and improving

* As the result of the experiments upon syphilization made by Dr. Boeck, he concludes—"The soft chancre and the indurated are the product of the same virus ; these two forms being due to the varying intensity in the virus. The soft chancre is the product of a more energetic virus, which, in virtue of its intensity, developes such a degree of inflammatory irritation in the parts around the sore, as to prevent the occurrence of absorption. The indurated chancre is the product of a virus less intense, which is not accompanied by a sufficient degree of the inflammatory process to prevent absorption. When the matter is very intense, the characteristic soft chancre is obtained ; if it is less intense, the indurated chancre results ; a pus of intermediate intensity produces the intermediate forms of chancre."

the general health. The explanation of these facts is, however, a very different matter, and one of acknowledged difficulty. Those even who adopt syphilization as their only plan of treatment, are by no means at one upon this subject. Auzias Turenne and Sperino attribute its good effects to "the absorption of the virus, and the saturation of the system with the poison"—the immunity ultimately reached from further inoculation indicating that this condition of system is attained. This, however, is a most novel and untenable doctrine, either in general or special pathology. In the first place, it is founded upon the assumed identity of the virus of the soft and indurated chancres, else what good can accrue from the repeated inoculation of the soft chancre, in the way of producing systemic saturation, if the soft chancre be only a local affection? In the second place, what facts or analogies can serve to prove that a large dose of a poison will diminish the effects of a lesser? The alleged identity of the virus of the soft and indurated chancre is a most gratuitous assumption, and one which all our experimental research leads us to disbelieve and contradict.

By Professor Tage of Christiania the cure of the syphilitic symptoms by syphilization is attributed to a depuratory action effected by the sores produced by successive inoculations; and this view of the subject seems to be borne out by the fact, that the introduction of a seton, repeated blistering of the surface of the chest (Cullerier), the inunction of croton oil into the surface, or the application of antimonial ointment or plaster, have been found equally efficacious in promoting a cure. To the use of such measures Boeck objects; but not because he adopts the saturation theory; this he very reasonably rejects, as, if true, leading to but one logical conclusion, viz.—that it should make the syphilitic diathesis worse instead of better. He objects because the period when the completion of the desired effect has been attained is not indicated, as in the so-called syphilization process, by a condition of immunity being reached. To ourselves the effect of the inoculation, as well as that of the seton, or of the pyogenic counter-irritants, seems due to the concentration upon one part of the surface of a suppurating condition which relieves the tendency to a general eruption, and, by effecting at an early period a prolonged suppurative crisis, hurries the diathesis over that stage of its development. The only peculiarity in regard to the process of syphilization which remains as yet unexplained, is the cause of the immunity to further inoculations which is attained after a time. From the fact that such immunity is produced not generally, but first in one locality and then in another, it seems to be due merely to a diminution or loss of the reacting power of the cutaneous surface in response to stimulation. And from the fact that syphilization can be repeated, should syphilitic relapse render it necessary, this immunity seems to be not only partial but temporary. Recently a suspicion has been excited in the minds of some, that possibly syphilis requires no treatment; that, left to itself, the cutaneous affection would disappear, and the results be even more favourable than the more systematic measures which have hitherto been regarded as essential in the disease.

In taking a retrospective glance at the various methods of cure to

which we have adverted, in this somewhat lengthened exposition of the treatment of the indurated chancre and its consequences, we would :

1. Reiterate, that constitutional treatment should rarely be employed until the constitutional symptoms begin to manifest themselves in the form of an eruption ; local treatment usually sufficing for the indurated sore.

2. That secondary symptoms undoubtedly disappear more rapidly under the regulated use of mercurials, than from any other plan of treatment. That, by their continuance, immunity from the risk of relapse cannot be promised ; but that a six months' continued administration of mercurial treatment, followed by three months of iodide of potassium, is more likely to secure this than any other medicinal methods devised.

3. That iodide of potassium is a remedy of real value, only in the tertiary stage of the disease.

4. That warm bathing, purgatives, hygiene, and dietetics, are very important adjuvants in treatment.

5. That syphilization is a trustworthy plan of cure, and deserves more extended application to the treatment of syphilis. That its progress is gradual, and calculated to interfere little, if at all, with the ordinary life and habits of a patient ; any uneasiness arising from its use rarely lasting beyond the first fortnight.

6. That as the virus employed in so called syphilization is really that of the soft chancre, which is a merely local disease, this method had better be denominated *Chancrization*, as better indicating what is meant by the process, and as asserting a duality instead of the generally admitted unity of the chancrous virus.

7. That there is good reason to suppose that the use of any pyogenic irritant would effect an equally satisfactory result ; the virus of the soft chancre being convenient for the purpose, merely because the sores which form suppurate freely and remain for a long time open.

8. That by no method of treatment can a patient be considered so free from all tendency to the evolution of symptoms, as to be regarded secure against their reappearance ; and that for reasons to be mentioned immediately. Such patients, therefore, should not be permitted to marry for at least a year after the commencement of the infection.

Infantile Syphilis.

Syphilis, as it occurs in young children, may either be *congenital* or *acquired*. In the former there is no lesion of the surface by which the poison has gained access to the system ; in the latter there is precisely as in the adult, except as regards site, a local point of departure in the form of an indurated chancre from which the poison radiates its influence throughout the system.

The Congenital infection may be due either to (1) the father, or to (2) the mother, or to (3) both parents being under the influence of secondary syphilis at the period of conception. In some cases again, it may be induced by the (4) mother becoming infected after conception has occurred.

The acquired Syphilis of infants is usually acknowledged to be due to

(1) contact of the cutaneous surface with the maternal passages affected with disease ; or to (2) the presence of a morbid lesion (*a*) primary, or (*b*) secondary, in the nurse who suckles it—acting either directly through the mouth of the child, and the parts with which it comes in contact, as in sucking, kissing, etc., or through the medium of the milk excreted from tainted blood ; or (3) the infection may be due to accidental circumstances of exposure, either to the indurated chancre, or to secondary lesions, in other individuals with whom the infant may be brought in contact ; while lastly, the infection may be produced by (4) vaccination, the syphilitic virus being mingled with that of the vaccine disease. The infant is, therefore, exposed to the action of syphilitic virus from various different sources, at the earliest age.

The effects of the poison in the congenital cases is sometimes *foeticidal*—indeed very generally so when the infection in one or both parents is recent ; the foetus perishing during intra-uterine life, and undergoing consequent expulsion from the womb. This fatal result is due in some cases to disease of the placental structures, in others to changes in the internal organs of the foetus, accompanied perhaps by cutaneous eruptions. When the foeticidal effect is escaped, the child may be born with syphilitic manifestations upon the surface ; this, however is exceptional—for, as a general rule, the signs of diathesis only appear after birth, a certain period of apparent good health intervening. This period of latency rarely exceeds one month ; and when the third month has elapsed without the appearance of some sign of a syphilitic infection, there is no likelihood that any such symptoms will occur.

Congenital syphilis is characterized by a shrivelled, lean condition of body ; the general aspect and expression being those of “a little old man.” The skin generally presents a dirty coffee and milk tint ; that of the nates, vulva, or scrotum, becomes of a smooth glazed appearance, and of copper colour—ending in desquamation and cracking, or in becoming moist and oozy. The mouth and throat are affected at the same time with condylomatous patches ; occupying especially the angles of the lips, the throat, and nostrils, and accompanied with puckering of the mouth, a hoarse cry, snuffling breathing, and running from the nose. Iritis may occur about the same period ; and that more frequently than has commonly been supposed—usually of the tubercular form. *Pemphigus* of the surface frequently appears ; but is not necessarily pathognomonic of syphilis, without some of the other symptoms just mentioned co-existing. At a somewhat later period, *ecthymatous* or *impetiginous pustules* show upon the surface, forming crusts or ulcers ; and affections of the periosteum and bones may also occur. In fatal cases, the internal organs have usually been found affected ; the liver becoming enlarged, globular, and hard ; the lungs and thymus-gland suppurating ; and, in some cases, peritonitis is developed. Before death, vomiting and diarrhoea usually set in. In congenital cases, especially where the disease is inherited from the mother, induration of the liver may be expected ; this seeming to occupy the place of the induration of the chancre and of the lymphatic glands which occurs in the acquired disease. In children who have in infancy suffered from congenital syphilis, a paucity of the eyebrows and eyelashes, a tenuity of hair, with radiating lines surrounding

the mouth, imperfectly developed nails, "pegged teeth," and a tendency to "dotted" keratitis, frequently remain for life, to mark the cause of the constitutional condition of the individual, and to form a key to various other diseased states from which he may suffer.

The treatment of congenital syphilis may often be preventive. Thus a man or woman, suffering from primary or constitutional syphilis in its secondary stage, should on no account be permitted to marry, until every manifestation of the disease is cured, and, at all events, a year from the period of invasion has been permitted to elapse. This, indeed, is not enough; for the disease has been known to remain latent for several years, and again break out—perhaps in the parent, but certainly in many cases in the offspring, while the parent manifests no trace of the evil. When, therefore, the treatment previously employed has been unsatisfactory, a thorough constitutional course of mercurials, or syphilization, should be had recourse to before marriage is sanctioned. Should marriage, however, have been contracted, or should the individual suffering from syphilitic disease be already married, means must be taken to prevent conception; and although various expedients for avoiding the result, without renouncing the means, have been recommended, and even safely employed, nothing but the renunciation of all sexual intercourse can be certainly depended on. Should conception have taken place before the medical man is consulted, the rapid and forced administration of anti-syphilitic treatment is the only chance of saving the foetus, and of protecting the mother against the risk of infection by absorption of the disease through her placental connection with the foetus. When the husband is the source of the contamination, he, too, should be subjected to a like process of treatment.

Again, should one or more abortions have occurred in succession, followed by the birth of a living but syphilitic child, both parents should at once be subjected to treatment—if the father is the source of contamination; the mother alone, if the father has never had any syphilitic manifestation.

Curative treatment in the infant should be commenced at as early a period as possible. This may consist of either the exhibition of mercurials, or the employment of syphilization. Iodide of Potassium in such cases is, in the early stage of the disease, a mere waste of time.

In employing syphilization, the pain which attends upon the formation of the ulcers may require the employment of opiates; but the process has no other peculiarity in its adaptation to even a child of the tenderest age.

When mercurials are employed, the endermic use of the remedy is to be preferred, as being less irritating and less liable to cause enteric complication. The application of the blue mercurial ointment, spread on lint or leather, and kept constantly in contact with the abdomen by means of the binder, is all that is required. Local treatment should consist of great attention to cleanliness and the application of desiccants, such as oxide of zinc powder, to which a small portion of calomel or a large proportion of grey powder may be advantageously added. Of lotions, the alum and oak bark for the oozy state of the skin—the nitrate of silver, three grains to the ounce, for the affections of the mouth,

throat, and nostrils—seem to be best ; while sulphate of copper lotion, or black-wash, two grains to the ounce, form suitable dressings for the ulcers upon the surface. The treatment of the child should never be commenced until the symptoms are distinctly present, and should be continued, in regard to mercurials, as long as any symptom of syphilis remains. If commenced within the first ten or twenty days after birth, it is rare to find it necessary to continue the remedy longer than three months. If Iodide of Potassium or Iodine in any form is employed, it is best given in the form of baths, or fomentations applied to the surface.

Acquired Syphilis, as already stated, is supposed to be capable of development in a variety of ways. But in all cases, however much facts and inferences may be disputed, it is satisfactory to know that the initial lesion is invariably an indurated chancre, and never a secondary affection ; and, further, that it always occurs at the point exposed to the influence of the syphilitic infection—be that point the mouth and lips, the arm, or other part of the cutaneous surface. As to the facts, and inferences from them, which are supposed to establish beyond doubt the various alleged modes of the transmission of secondary syphilitic lesions, not only to infants, but from them to other children, and even to adults—they have always appeared to be so defective in completeness, and in absence of all risk of error, as to prevent any absolute belief in their conclusiveness. One may, indeed, appear sceptical, by thus expressing a want of faith in what has been written and observed with so much honesty ; especially as a positive assertion always outweighs a mere negative in experience ; but, while bound to express the absence of conviction, in regard to the facts of this subject, we are most willing to recommend adoption of the rules which have been deemed suitable to prevent communication of the secondary symptoms of the disease in all of the ways above mentioned. 1. A diseased nurse should never be employed for a healthy child, nor a diseased child suckled by a woman who has not previously had syphilis. In examining a nurse for the purpose of determining that she is not syphilitic, the condition of the cervical glands, scalp, chest, and breasts, taken into account with the health of her child—excluding all risk of imposition as to the child being her own—should afford sufficient guarantee as to her soundness. 2. The friends, followers, or husband of the nurse, should be kept away from her while she is nursing. 3. When vaccine matter is taken for the purpose of preservation, and employment in the vaccination of other children, the health of the child as well as that of its parents should be considered ; and the source from which every charge is obtained should be carefully noted, so that after reference may be made in any case of doubt. 4. The vaccine matter should consist of the pure lymph, without admixture with blood or curdy matter, and should be taken only when the vaccine vesicle is at its fully formed stage—when, in fact, its nature is rendered indubitable.

Treatment of acquired syphilis in infants, is in all respects that of the congenital form of the disease.

Chancres and Syphilis in the Female.

In the female, syphilis is peculiar only as regards the primary affection—and the peculiarity is chiefly as to the site : the slightly developed degree of induration of the base of the sore, observed in many cases ; the tendency in the sore to undergo a transformation *in situ* into a condylomatous surface ; the early appearance of condylomata, and their persistence upon the vulva ; while the general character, progress, and results of the chancre, and the constitutional disease, are similar to the occurrences in the male. Sometimes, again, the chancre is of large size ; and, seated on the labia, may involve one or both in hypertrophy, which sometimes refuses to yield to constitutional treatment, and requires removal by the knife. Chancres of both kinds are usually situated on the inner surface of the nymphæ, on the carunculæ, and in the orifice of the vagina at the inferior commissure ; but they are also found in all parts of the vagina, on the os uteri, and sometimes in the urethral orifice. They may affect the anus, either primarily, or, in the case of the soft chancre, by discharge from the vulva running in that direction when the patient is recumbent. When an indurated chancre exists at the anus, the multiple glandular enlargement in the inguinal region has usually the most external gland of the chain specially affected. Treatment is as in the male. Warty formations occasionally are of such size, as to require a regular dissection for removal of the hypertrophied mass.

CHAPTER LXI.

AFFECTIONS OF THE URETHRA.

Stricture.

CONTRACTION of the urethra, interfering with micturition, and rendering the process slow and painful, may depend on one of three different causes.

1. There may be *Spasm* of the muscles connected with the membranous portion of the urethra, causing temporary obstruction to its normal calibre at that part, as well as resistance to instruments attempted to be introduced ; and there is good reason to believe that a similar result is sometimes occasioned, in the anterior portion of the urethra, by spasmodic action of the muscular fibres which have lately been shewn to form part of the normal structure of the urethra, and to extend throughout its whole length—continuous posteriorly with the muscular coat of the bladder.* These conditions are liable to be suddenly induced, by ordinary exciting causes, such as exposure to cold, the effects of a debauch, the presence of irritation about the anus, or the action of cantharides ; and they generally disappear readily—often rapidly—under ordinary treatment ; such as chloroform, hip-bath, fomentation, opiate enema or suppository, perhaps a sedative by the mouth, rest, quietude, antiphlogistic regimen, and the use of laxatives—advantageously followed by the employment of tincture of the muriate of iron, should the symptoms continue. 2. *The inflammatory process*, by its attendant swelling, may cause contraction. It may affect the lining membrane itself ; either at one point, as in consequence of injury ; or over a considerable space, as in severe gonorrhœa—one of the symptoms of which, as we have seen, is an obvious diminution of the stream of urine, dependent on the contracted state of the canal. Or the inflammatory process may be exterior to the urethra ; in the substance of the prostate, in the areolar tissue of the perineum, or by the side of the rectum ; and the bulging of the phlegmon, or abscess, may not only diminish the calibre of the urethra, at the affected part, but may even shut it up altogether, causing retention of urine. The treatment of such a case has already been considered ; it is by antiphlogistics ; using the bistoury for evacuation of matter, or even at an earlier period before matter forms, while the tissues are as yet only thickened, indurated, and congested. After incision, should the patient still be unable to void his urine, and the bladder be distended, the catheter should be employed. 3. The canal may be narrowed by chronic structural change, occurring in the urethra itself ; and this constitutes true or *organic Stricture* ; a condition which is ever liable to complication and aggravation, by the two preceding causes of contraction—

* HANCOCK, Lancet, No. 1486, p. 187.

spasm and the inflammatory process. And it is well to limit the use of terms thus : understanding "spasmodic stricture" and "inflamed stricture" to be aggravations of true organic stricture in one or other of these ways ; understanding the terms "spasm of the urethra" and "urethritis," to include the condition of temporary narrowing of the canal by spasm and the inflammatory process ; and understanding by "stricture," an organic change in the urethra, causing a narrowing of the canal, which may be altogether independent both of spasm and of existing inflammatory disease.

But stricture results from the inflammatory process, in and near the urethra ; and this, as we have seen, may be excited in various ways. 1. It may follow the application of a source of irritation to its mucous membrane, as happens in gonorrhœa ; and this is perhaps its most frequent cause. Clap is of common occurrence ; the inflammatory process, in the chronic or gleet stage, is often of long duration, as well as of a kind to favour plastic change in the submucous tissues, without the use of injections having anything to do with the formation of the structural change ; at the same time, treatment by injection may be so mis-conducted, as to cause aggravation of such affection when it has once commenced. 2. Stricture may follow a chronic inflammatory process, always of a minor grade—never reaching beyond textural irritation—occasioned by constant excitement of the canal ; as by excess in venereal indulgence, or by an acrid state of the urine. The latter is no uncommon cause ; the urine may be unduly acid, or concentrated, or holding in suspension more or less deposit ; the irritated bladder is emptied frequently ; and, on each occasion, the urethra smarts under the passage of the urine. At length, a continued state of irritation of the canal is induced ; producing not only discharge from the free surface of the mucous membrane, but also a certain amount of submucous plastic change which permanently remains. 3. External injury may be the exciting cause ; lacerating the canal, wholly or partially, at some point, and admitting of retraction of the torn textures and separate cicatrization ; besides, in most cases, lighting up an active inflammatory process in and around the injured part, and tending to much solid product—not always amenable to absorption. Hence, blows and kicks on the perineum are found to produce the worst forms of the affection. A less amount of violence, often repeated, may induce gradual formation of stricture ; as by contusion of the perineum on the saddle, in dragoons or others much employed on horseback. Also, there is good ground for suspecting, that the disease not unfrequently originates in the unskilful or unnecessary use of bougies, lithontriptors, and other instruments. 4. Ulceration of the urethra cannot well heal, without causing more or less contraction of the canal ; and this ulceration may be either of a common or of a specific kind. Such ulceration was at one time frequently induced by the use of caustic potash in the treatment of strictures of the urethra. There is no more troublesome form of that disease than contraction of the orifice, in consequence of chancre situated there ; and it is not unlikely that such specific ulceration may extend backwards beyond this point, even as far as the bulb, and thus act as the cause of stricture in its most common sites.

The proximate cause of stricture is fibrinous product, and consequent structural change, sometimes in the lining membrane of the urethra, more commonly in the submucous areolar tissue, or in both together—but chiefly in the latter situation; never the result of the formation of false membrane upon the free surface of the mucous canal. The ordinary sites of stricture are—at the orifice; at the neck of the glans, and about an inch and a half from the orifice; at the natural bend of the penis, from the suspensory ligament; at the scrotum, and immediately behind that point, between three and four inches from the orifice; and in front of the membranous portion of the urethra, at the bulb, between six and seven inches from the orifice. The researches of Sir C. Bell, and others, have demonstrated that contraction of the urethra seldom, if ever, occurs posterior to the bulb of the urethra. The most frequent sites are the two last named. But it is seldom that a tight stricture is found at the posterior part of the urethra, without more or less contraction also at the ordinary sites in front; in other words, in cases of bad stricture, a plurality of contractions may generally be expected. When the affection results from external injury, the site obviously must depend on its nature and point of application.

The extent and degree of contraction vary. Sometimes a shred of membrane crosses the canal; and this excessively rare form, resulting probably from the formation of a very limited false passage in a contracted canal by the awkward use of instruments, is termed the *bridle-stricture*. Sometimes the stricture is tight, but very limited, seeming as if a thread had been tied firmly on the part. This, which is much more common, is termed an *annular stricture*; and if the altered condition extends beyond the mere mucous membrane, such contractions have been called *indurated annular strictures*. More frequently still, the contraction is of greater extent both in depth and length; extending in length from a quarter of an inch to an inch; or sometimes involving several inches of the canal. And the degree of thickening, contraction, and irregularity of the channel varies, according to the duration and treatment of the disease; from the slightest narrowing of the canal to its almost complete occlusion, with alteration of structure extending in the form of induration throughout the entire depth of the corpus spongiosum, and even beyond this—especially when the irritation has been great, and fistula in perineo has existed as a complication.

By the older authors on surgery, caruncles, excrescences, warty growths, or polypi of the canal, were presumed to be very common causes of stricture, or obstruction to the passage of instruments. Such formations do undoubtedly sometimes exist in the prostatic part of the canal, and neck of the bladder—situations where stricture never occurs; and at times a small granulation or wart may be seen just within the orifice of the urethra; but the statement that such structures constitute a cause of stricture obtains no support from pathological research.

Behind the constricted point, dilatation takes place. Anteriorly to the actual stricture, there are collapse and contraction. The dilatation may be to such an extent as to hold more than one ounce of urine; and the mucous lining of the dilated part becomes prone to ulceration. Calculous matter may be retained there; and a stone may form, occupying

the whole space. The mucous lining of the entire canal sympathizes more or less. From the strictured part, and also from the general surface of the membrane, an abnormal discharge proceeds; usually clear, sometimes puriform; and liable to be increased by casual excitement—this inducing aggravation of the congestion. Ulceration of the canal at and behind the seat of constriction sometimes occurs; the destructive process extending either from the superficial mucous surface, or from supuration occurring in some of the dilated mucous crypts situated in the dilated part of the canal. This constitutes in some cases the early stage and cause of urinary extravasation and fistula; the urine gradually making its way through the tissues which are breaking down under the ulcerative change. In most cases, however, the urinary extravasation, proceeding from stricture, is preceded by the formation of an abscess—external to the canal at its constricted part—which, making its way towards the urethra more readily than towards the surface, may open into the passage and thus admit the escape of urine into the abscess-sac. Should this, however, have been incised, before spontaneous evacuation into the urethra has taken place, the canal may afterwards open by ulceration and urine escape through the wound. Chronic prostatitis is apt to be induced; increasing the discharge. The lining membrane of the bladder becomes affected; the muscular coat too is changed, becoming hypertrophied; and, in consequence, both fasciculation and sacculation of the viscus may take place. The enlarged muscular fibres, arranged in bundles, act strongly on the urine; and the urine, not getting freely away through the strictured urethra, reacts on the mucous membrane, causing protrusion of this through the interspaces of the fasciculi. Cysts, thus formed, receive gradual additions to their parietes, and may attain to a large size—rivalling the bladder itself in magnitude; but this condition is not so common as in cases of diseased prostate. Chronic cystitis may follow. And morbid sympathy does not end with the bladder; the kidneys are in many cases involved; first in irritation, causing functional derangement only; afterwards in organic disease. The pelvis of the kidney and the ureters are often enormously dilated, their lining membrane furnishing much puriform discharge. The formation of stone, too, is favoured, as was formerly remarked; derangement of the kidney's secretion leads to calculous deposit, and this is obstructed in its outward passage by the urethral change.

The symptoms of stricture are of gradual invasion, and may for some time escape the patient's notice. The urine is passed in an attenuated stream, sometimes twisted, sometimes scattered, sometimes partially dribbling; the act is both frequent and tedious; and sometimes it is accompanied by pain and uneasiness in the bladder, perineum, and penis, which abate on the bladder being emptied. After the patient supposes evacuation complete, a few drops—in some cases a considerable quantity—pass away involuntarily; coming from the dilatation behind the stricture, through the indurated and constricted part which, temporarily dilated by the stream of water, slowly closes under the influence of the muscular textures of the urethral walls. In consequence, the clothes are usually soiled and stained. The increased frequency of micturition is most observed at night. A gleet discharge comes from the urethra,

as already stated ; and excess in diet or exercise may induce aggravation, resembling an attack of gonorrhœa, and very probably implicating the bladder. Pain is complained of in the loins and thighs, and in the perineum ; often erection is painful. In tight strictures, the urine may pass only *guttatim* ; and then, too, there may be no escape of semen in emission—this fluid passing backwards into the bladder, to be afterwards discharged in an altered state along with the urine. The testicles are liable to enlargement ; and the rectum frequently sympathizes—becoming prolapsed, or inflamed, or fissured, or ulcerated, or affected with hemorrhoids ; sometimes strictures of the urethra and of the bowel are found to co-exist. The straining, in bad cases, is such as to empty the rectum as readily as the bladder ; and in consequence the water-closet has to be used instead of the chamber-pot. Often hernia is induced. The prostate is liable to become not only excited but enlarged ; and if this enlargement be chronic and simple, relief from the symptoms of stricture may be experienced ; the prostatic tumour acting as a break-water, in favour of the part originally affected. But if ulceration or abscess affect the gland, then aggravation must necessarily ensue. As the kidneys suffer, their secretion becomes more and more changed ; and the acrid urine, passing frequently along the urethra, reacts unfavourably on the urethral disease. The complication of rigors followed by fever passing off in copious diaphoresis—or, in other cases, of gouty rheumatism—is by no means unfrequent, in those advanced in years, and who have lived freely ; often with irritability of the stricture ; and such intercurrents are specially apt to appear after instrumentation. Retention of urine is at any time liable to occur ; the degree of constriction being suddenly increased by spasm, or by inflammatory swelling, or by both. From this cause, extravasation of urine may follow ; urinous abscess, however, ending probably in the formation of fistula in perineo, is more common—generally producing mitigation of the symptoms, at least for a time, as will afterwards be explained. In severe and protracted cases, the general health suffers materially—independently of all accident ; the flesh and strength fail, the digestive organs are impaired, the face is sallow, and the features wear an expression of anxiety almost pathognomonic of the disease. Constitutional irritation sets in ; the symptoms denoting organic disease of the kidneys become more and more marked ; purulent, mucous, ammoniacal urine passes often, in small quantities, and with much distress ; febrile exacerbations recur with greater force and frequency ; emaciation advances ; the appetite and digestion fail more and more completely ; at length coma may supervene ; and the patient perishes.

Treatment is conducted on simple principles ; but a satisfactory cure is often of very difficult attainment. Our object plainly is, to get rid of the redundant formation which causes the contraction ; and this may be effected in one of two ways : 1. By simply procuring absorption, under the stimulus of pressure ; 2. By so managing the application of pressure, as to establish a temporary and active irritation in the part, which, on its resolution, may induce rapid diminution of the product. Advance of the inflammatory process, however, to a high grade is obviously to be avoided ; suppurative results will cause further new formation around ; and

ulceration—at the time perhaps widening the canal—is likely ultimately to lead to renewed and probably aggravated contraction, by puckering of the cicatrix. Besides, ulceration, to prove effectual on the submucous formation—the true cause of the stricture—must first penetrate and destroy the mucous membrane; an event never desirable; 3. In bad cases, the knife may be necessary to divide the contracted part; not, however, as a sole means of cure; but materially to assist the bougie in afterwards establishing the normal condition of the part.

To obtain the curative result, in ordinary cases, cautious management of the metallic bougie is now universally acknowledged to be the most suitable means. But, in the first instance, exploration is necessary; to ascertain whether a stricture really exists or not; as also its nature, site, and extent. A metallic instrument should always be used for this purpose. Formerly one of wax was preferred, as less formidable to the patient, and because it was believed that its softened extremity would mould itself against the stricture, so as to produce an accurate image of the state of the urethra at the constricted part. The most convenient kind of bougie is that manufactured of Berlin silver; the larger sizes hollow, and consequently light, firmer than silver, yet possessing a smooth surface, and not subject to become roughened from rust as steel would be. The curve should be gradual and slight—a segment of a large circle; and the set of instruments are arranged in a gradually ascending scale, from the smallest wire-like form and probe-pointed extremity, to what is likely to fill the average canal in its normal state. The selected instrument is oiled, or smeared with cold cream. For purposes of exploration a large instrument is obviously not suitable; neither is one of small size—for it is liable to catch a lacuna, and so to simulate stricture where there is none; or, passing through a stricture of no great tightness, it may lead to the belief that the canal is clear, while contraction really does exist. One of the medium size is selected; and, having been warmed suitably, by the hand, is introduced cautiously. If obstructed, it is gently withdrawn a little, and again guided on; a fold of the urethra may have been in the way. If, however, still opposed, the existence of stricture may be fairly presumed; and its site is noted, by observing the extent to which the instrument has passed, and by manipulating the course of the urethra. An instrument one or two sizes smaller is then taken and passed along the canal to the site of the stricture, where careful efforts are made to insinuate it along the contracted channel. Should it still prove too large, another and another, if need be, is employed, till the instrument is found which can be passed both through the stricture and onwards into the bladder. Having succeeded in this, some surgeons recommend that the instrument should be retained from a minute to half an hour, or more, according as the patient's feelings may indicate. This is not, however, usually desirable or safe; and certainly, if sickness occur, or if much pain be felt, and on the increase, or if the patient express a decided wish for removal of the instrument, stating his belief that it is “hurting” him—it should be withdrawn; remembering that our object in the use of the bougie is not mechanically to stretch the canal, but to excite absorption of the morbid product in the submucous tissue. To attain as great an

effect as possible, when the patient is not irritable, two or three instruments of increasing calibre may be passed one after another, till a size is reached which is as large as can readily be admitted, and which seems to draw the stricture along with it when being withdrawn. Rest and temperance are essential, for that day. On the second or third thereafter, we expect the uneasiness occasioned by the former introduction to have passed away; and the operation is repeated; introducing the same instrument as was passed at the last visit, then immediately withdrawing it, and substituting a size larger. And this is repeated at longer or shorter intervals, until the full size is passed readily. This last is repeatedly introduced at the ordinary intervals, until all obstruction has fairly disappeared; and then the stricture may be regarded as cured—though not finally disposed of. A tendency to recontraction remains. And, to obviate this, an occasional bougie is required—sometimes termed the *protesting* bougie—at a gradually increasing interval; the first introduction taking place at the end of a fortnight, then after a month, then after two months, and so on; until, after introduction at an interval of six months, all is found normal. Thus only can immunity from relapse be secured.

Such is the ordinary course of events, in a plain, simple, and uncomplicated case; but many circumstances require attention besides. And, in the first place, in commencing the treatment of stricture, it is essential to have regard to the general health, and especially to the state of the urine. If an acrid fluid be frequently passing over the canal, little or no progress can possibly be made; the disease need not be expected to give way, while a cause of maintenance, if not of origin, is in constant operation. It is also very important that regimen should be strictly regulated; and that walking exercise should be indulged in as little as possible. Horseback exercise must be absolutely prohibited.

In passing the bougie, the instrument is held lightly in the hand, and carried with its point gliding along the upper wall of the urethra, and must never be pressed onwards with much force. In fact, it is always preferable, in passing the instrument, to employ only one hand, without any pulling or stretching of the penis forward upon the bougie. In this way the instrument is less likely to become impacted, the natural obstacles to the passage being more effectually and certainly overcome, while the patient suffers less uneasiness, and the operation is in reality more easily performed. Where the stricture, however, exists in the anterior or pendulous portion of the canal, the penis should be held upwards in a perpendicular direction, while the instrument is carried through the constriction. It is essential to remember in all instrumentation of the canal that force of propulsion, and tightness of grasp, may tear the urethra, pushing the unentered stricture before the instrument's point—if this be kept straight; or, if any divergence be made from the true direction of the canal, the parietes are perforated, and a false passage established. Lightness of grasp, and gentleness of propulsion, permit the instrument to be restrained by the walls of the urethra; and all such hazards are avoided. The point is pressed steadily on the stricture for a short time; and then, withdrawing the hand, we observe whether the instrument resiles, or remains fixed in its place; if the

former event occur, it is a sign that no penetration of the stricture has taken place ; the latter is a token of the instrument's point being lodged in the contracted part. And according to the evidence thus afforded, either a smaller instrument is selected, or the onward pressure is steadily maintained. In the latter case, our chief care is to avoid the use of force, and to exert the steadily maintained pressure not on the sides of the canal, but on the obstruction in its direct course ; and, to assist in this, when the stricture is behind the scrotum, the fingers of the left hand supporting the middle of the perineum, or lodgment of the forefinger in the rectum, are often of use.

An obstacle may be felt at the bougie's point, near the neck of the bladder ; and yet it may not depend on stricture. The canal may be of its normal calibre throughout ; but made tortuous, by unequal enlargement of the lobes of the prostate. In such a case, a flexible instrument is more likely to pass than one of metal ; the passage is to be traversed, not forced—"arte, non vi"—and then much assistance is derived from the finger up the rectum. In passing instruments along a healthy urethra, it is well to recollect that there are certain situations in which the folds of the mucous membrane, the direction of the canal, or the awkwardness of the operator, may hitch the point of the instrument, and either lead to the belief that a stricture exists there, or in attempts to overcome the obstruction by force, may lead to rupture of the canal, or the formation of a false passage. These sites, besides the prostatic one already mentioned, are the lacuna magna of the urethra, situated in its upper wall, a little behind the glans ; the junction of the pendulous and scrotal part of the urethra ; the sinus of the bulb ; and the membranous portion of the canal where it passes through the triangular ligament. The usual direction given for the avoidance of these sources of fallacy is to keep the instrument bearing along the floor of the urethra, till within two inches of the verge of the anus ; then, supporting the point of the bougie by the fingers pressing upon the perineum, to urge it gently onwards, while the right hand, holding the instrument lightly, is carried downwards between the patient's thighs, describing the arc of a circle. The difficulties in the anterior and perineal part of the canal are most apt to occur in the use of gum-elastic instruments. Another obstacle, not connected with the canal, has occasionally caused difficulty in passing a bougie—viz., osseous formation on one or both of the rami of the ossa pubis, or upon their symphysis ; the result of injury, or of idiopathic osteitis. It is of rare occurrence. A cautious turning of the instrument's point to a side will probably elude such obstruction.

A stricture, at first wholly resistful of the instrument's point, may in a short time yield to it. Instead of attempting at once to penetrate, therefore, if satisfied that the instrument is bearing against the orifice, steady pressure is kept up ; and after a few minutes we may expect such an amount of relaxation and dilatation to take place, as may admit either of the instrument passing completely, or of its becoming lodged in the strictured part.

It is not absolutely essential to the cure, that penetration of the stricture should be complete at first ; although without this, and the conveyance of the instrument into the bladder, we can have no absolute

certainly that the instrument is in the right route ; for we may all the time be merely extending a false passage which exists anterior to the stricture, or fruitlessly pressing against a fold of mucous membrane at the side of the strictured portion of the canal. This process of "vital dilatation," as it has been called—largely employed by Dupuytren, Guthrie, and others—is effected as follows :—Having found a tight and unyielding stricture, which will not, for the time being, permit penetration, even by a very small instrument—provided there be no threatening of retention of urine, or other source of urgency—we lay aside small bougies, and the determination to penetrate, and selecting an instrument of medium size, pass it down to the stricture, and retain it there, pressing upon the stricture, rather than in it, so long as is thought necessary, and the patient's feelings will allow. This is repeated, at the usual intervals. And, after several such introductions, relaxation will be found gradually advancing, so as to admit first of partial lodgment, and afterwards of complete penetration. No time is lost ; and, if properly employed, no risk is incurred. The principle of cure is obviously the same as that of the ordinary use of the instrument.* In the hands of a careless operator, however, there is risk of making way, not along the contracted canal, but through the soft and normal mucous membrane on the exterior of the stricture.

Should, at any time, over-excitement—as evidenced by tendency to bleeding, pain, spasm, and discharge—occur in the part, from over-use of the bougie, exposure to wet, fatigue, intemperance—all instrumentation must be desisted from, for a time ; until, by rest and antiphlogistic regimen, a quiet and tractable condition of the canal has been restored.

In receiving the bougie, the patient may be either erect or recumbent. If it be his first experience of such an operation, the latter posture is preferred ; lest faintness occur, as is apt to be the case. After one or more repetitions, in a well-dilated stricture, when such tendency ceases, and no difficulty exists, then the erect posture, if more convenient for both parties, may be preferred. The surgeon, seated in front, passes the instrument with its convexity directed towards the abdomen, down to the suspensory ligament ; and then gently depressing the handle, while the instrument is slowly turned half round, this natural obstruction is overpassed. To avoid injury to the canal here, it is well to move the point mainly on the upper surface of the urethra. If an opposite course be followed, a fold of the membrane is almost certain to be caught ; then rash pressure cannot fail to cause abnormal penetration—and a *False Passage* is begun. In all cases of tight stricture, or when care and pains are required to coax an instrument through a stricture, the recumbent posture should undoubtedly be preferred ; although there are some few cases where the altered position of the pelvis acting upon the membranous portion of the urethra, through the triangular ligament, renders the introduction of an instrument in the erect posture more easy than in the recumbent.

The evidences of a false passage being formed are :—The conscious-

* To this mode of procedure the term "tunnelling" has sometimes been applied ; portion after portion of the stricture being excavated, as it were, until a clear "driftway" has been established. I can vouch for its safety and efficiency.

ness of having used an unusual and unwarrantable degree of force ; an uncertainty as to the point having been in the true direction ; a want of the ordinary sensation of being grasped, as the pressure is continued ; a sensation of something having suddenly yielded ; when pressure is then continued, a feeling of roughness and rubbing on the instrument's point—and the bougie is then apt to advance, not smoothly, but per saltum ; a complaint from the patient of unusual pain—perhaps with a start, and then faintness ensuing ; blood welling out, in greater or less quantity, by the side of the instrument. Very frequently, the patient decidedly corroborates our own apprehensions, by declaring his conviction that the normal canal has been departed from.

Such things ought not to be ; the risk is great. And they need not be ; for by avoidance of force, and by the exercise of ordinary caution and skill, all such accidents are rendered more than unlikely. The only circumstances in which force is at all excusable, are those of urgent retention. Then the bladder must be relieved, as we have seen. But, of all the methods of affording relief, forcing the stricture is probably the worst. If there be time and indication, leeches, fomentation, hot-bath, sedatives, and antispasmodics are tried ; and, failing these, the obstruction is overcome by incision.

The risks of false passage are :—1. Escape of urine, and consequent sloughing or abscess, according to the extent and manner of the infiltration. If the false passage be incomplete, opening into the urethra only on the distal side, urine does not enter so readily as when the perforation is complete—having both a distal and a proximal opening. The incomplete form, consequently, is more likely to cause urinous abscess ; the complete, urinary infiltration. 2. Hemorrhage may be considerable. 3. Inflammatory accession may seriously affect the part, causing softening and ulceration ; and healing cannot take place without contraction—worse, probably, than the original stricture. And, besides, during persistence of the inflammatory process, constitutional disturbance is likely to be severe, bearing hard on a system already weak. 4. Or, in the especially feeble, a formidable amount of constitutional irritation may occur, irrespective of local inflammatory change.

A false passage having been formed, it is with difficulty avoided in subsequent introductions of the instrument. For some days, nothing should be passed along the canal ; an opportunity being thus afforded for closure of the track ; or, at least, for such diminution of it as may render entanglement of the instrument less likely. And when this is again used, it must be with a very lively caution ; the hand being alert, as it were, to notice the first and slightest deviation from the normal path.

In some patients, there is an especial irritability, which tends to balk the bougie ; perineal spasm supervening on the introduction being attempted, and receiving obstructive aid, probably, from a turgescient state of the lining membrane. Such a difficulty may be partially or altogether avoided, by the exhibition of a moderate opiate, by the rectum or mouth, about half an hour before the attempt at introduction—or by the employment of anæsthesia. Other patients are liable to suffer from agueish attacks, after the use of the bougie. Such are generally elderly persons,

who have lived freely and been abroad. They benefit greatly by the use of quinine.

Hitherto, we have been speaking only of the ordinary cases which require the ordinary application of instruments, in expectation of the ordinary result—disappearance of the redundant formation, by absorption ; this absorption being excited, simply and directly, by pressure. We now come to another class of cases, requiring another effect of the instrument—the second which we formerly noticed ; excitement of irritation, which in passing away may carry with it not only its own product, but also that of former times. These are tight and unyielding strictures, of considerable extent and long duration. A very small instrument may be insinuated into or through them ; but no progress is made ; on each introduction, there is the same difficulty to be overcome. In such cases, the treatment requires a modification ; a higher result is to be obtained from the instrument's use. A firm silver catheter is carefully passed through the stricture, and for this purpose must be lodged in the bladder ; it is there retained by tapes, which are appended to the rings of the instrument, and secured on the level of the perineum to tapes which encircle the upper part of the thigh, and which are attached to a bandage round the waist. The orifice of the instrument is shut, either by a stop-cock, or by a plug of wood or cork—which may be removed, from time to time, for evacuation of the urine. At first the catheter is felt tightly fixed, while the urine escapes only by its channel ; after some time, the embrace is found to become less close, while a puriform discharge comes from the urethra ; and the urine frequently, in twenty-four hours, flows freely by the side of the instrument, which will now be found loose and movable. It is then withdrawn, and a catheter of comparatively large dimensions may be passed in its stead. This is permitted to remain for other twenty-four hours, and may be replaced by a still larger instrument ; so that, in two days, the stricture which formerly admitted with great difficulty a No. 1 catheter, will frequently be found so softened and opened up, as to admit a No. 6 with facility ; after which the ordinary instrumentation is proceeded with, as in other cases.

This method of treatment, it is obvious, requires great care ; there being a risk of ulceration of the bladder from the constant pressure of the point of a small instrument against its fundus, as well as of untoward constitutional disturbance. And the case must be watched accordingly. The risk from pressure of the point against the fundus of the bladder may be somewhat provided against by the use of an instrument of sharp curve and short beak. In some patients, it may be safely retained for twenty-four, thirty-six, or forty-eight hours ; in others, that time must be greatly abridged. Opiates are of service, in allaying the pain and irritation. And if, by their use, all untoward symptoms are averted, we need not regulate the catheter's stay by any fixed limit of hours ; but may regard its thorough loosening as the first sign of the propriety of its removal. It is seldom, however, that a retention of more than forty-eight hours is required. And, in that short space of time, if the case proceed favourably, we may expect immensely more progress than under the ordinary system of management. This method is most frequently resorted to in cases where retention complicates

the stricture, and when, with very great difficulty, the bladder has been relieved by the passage of a very small catheter. In such circumstances, two results are secured by tying in the instrument—retention of urine cannot occur while it is present, and dilatation of the canal, with greater disposition to yield to the subsequent use of the bougie, is secured. Recently, in treating stricture by permanent dilatation, various devices have been fallen upon to obtain the easy passage of a larger and larger sized catheter, without withdrawing the original instrument, which remains as a guide. These are all modifications of Desault's method, by means of the long stylet over which gum-elastic catheters, of various and increasing sizes, were carried securely into the bladder. Of modern instruments, those of Mr. Wakley and of M. Maisonneuve are best suited to fulfil the object in view.

In many cases of stricture, with considerable difficulty a bougie of small size is insinuated along the constriction, and carried into the bladder—and this may even be followed up by the passage of instruments, one or two sizes larger; but no further progress is made; in two days the stricture is precisely where it was; or, perhaps, even with the most judicious management, it is rather more irritable and undilatable than formerly—while either actual retention of urine, or a threatening of it, or severe shivering fits followed by fever, may come on after each attempt to pass instruments. In such circumstances, it is manifestly of the greatest importance to get the stricture so opened up, as to save the patient from symptoms which may bode the most serious results, or at all events will defy the most carefully conducted treatment by the bougie, and resent the permanent tying in of a small catheter even for twenty-four hours. These irritable strictures, presenting this tendency to recontraction, have been specially described by Mr. Syme as *resilient* strictures. He has also shewn that while so obstinate under common methods of treatment, they yield readily to external division. In order to render such division of the stricture both accurate and safe, he has introduced into practice the use of a stricture staff, intended for a guide in the performance of this operation. This steel staff resembles in its curve an ordinary bougie, of the size of a number 8 or 10. Within an inch and a half, however, of its curve, it terminates abruptly in a much smaller continuation, which varies from the finest probe-size up to that of a number 3 or 4. This portion of the instrument, and about a quarter of an inch of the thicker part, are grooved deeply upon the back, in the middle line. In operating, the staff must first be passed through the stricture, and carried onwards along the urethra, until the thick portion of the instrument is arrested by the constricted part of the canal. The incision for division of the stricture is made externally through the perineum or scrotum, cutting down with a free incision made in the middle line upon the thick extremity of the staff. Having exposed the urethra, the point of the knife is made to seek the groove in the slender part of the instrument behind the site of constriction; and, with the edge directed forwards, the knife is made to run along the groove, till its further progress is arrested by the thick portion of the staff. The staff is then carried onwards to enable the surgeon to feel the thick part fairly in the wound. If the urethra is still felt covering it, and resist-

ing progress, the stricture is thus shewn to be incompletely divided ; the knife is again carried forwards in the groove, until it is arrested once more ; and then both staff and knife are moved on together, so as to secure complete division of the floor of the constricted part of the canal. The staff is now withdrawn ; and a short catheter resembling a female catheter, but with a short curve at its vesical extremity, is passed from the wound into the bladder, and retained there by means of tapes, passed and secured as for the lithotomy tube. This instrument should be supplied with a stop-cock, so as to prevent constant dribbling of urine, and contact of the vesical coats with its extremity. And this is all the more necessary, because it requires to be retained for some days ; till in fact all risk of urinary infiltration, and closure of the wound by adhesion, is past. In ordinary circumstances, the bleeding is very trifling, as the vessels of the corpus spongiosum, at a part where probably the erectile texture is obstructed, can alone furnish any hemorrhage. Should bleeding however occur, it is easily subdued by plugging the wound with dry lint, which is retained by a compress and T bandage ; or, should it seem necessary, the perchloride of iron may be used to saturate the lint or sponge employed for this purpose. The wound heals by granulation and gradual contraction. During this process, a full-sized bougie should be passed along the urethra, into the bladder, from time to time, so as to secure the patency of the canal, and gain the full advantage of the space afforded by the external incision. When the stricture is situated in the pendulous portion of the canal, or in that part which corresponds to the scrotum—instead of a free external incision, the stricture may be divided subcutaneously, entering a tenotomy knife into the groove in the staff behind the constriction, and carrying it forwards to the requisite extent, so as to free the instrument from all restraint. After this, either a full-sized catheter may be carried along the urethra, and lodged in the bladder ; or the urethra may be opened posteriorly in front of the bulb, and the short instrument already described introduced from the perineal wound, and retained till all risk from extravasation is past. When this method of dividing the stricture is adopted, bleeding into the scrotal tissues and penis may occur ; and, from the ruddy discoloration of the skin and tension produced, may excite apprehension in one unaccustomed to its performance, of urinary extravasation having taken place. Cold applications, with pressure over the site of incision, will check all further bleeding into the areolar tissue ; while the absence of all constitutional symptoms of extravasation within the next twenty-four hours, as the discoloration becomes darker from the ecchymosis presenting its usual characters, should prevent the surgeon from resorting to any unnecessarily severe measures. Those strictures which most frequently require external division, are usually situated between the bulb and scrotum.

There are cases of stricture in which, from their extreme tightness and unyielding nature—or the presence of inflammatory irritation, spasm, or false passages—especially when complicated by retention of urine—an instrument cannot be made to penetrate, though the stricture is no doubt really permeable. In those cases, when there is no urgency, some have been content with the treatment already noticed, of passing down a

bougie, of medium size, at the ordinary intervals, and retaining it in contact with the stricture for some time; expecting that, in this way, the desired diminution of abnormal product by absorption may advance. But, if excitement occur, the case becomes urgent by retention of urine; and then we are forced to relieve the bladder. Then there are only three ways of affording relief; the stricture must be got through, or the urethra must be opened behind the constriction, or the bladder must be punctured. A firm instrument, of suitable size, is patiently and gently used—remembering that by the inflammatory process the parts have had their lacerability much increased. For this purpose the steel probe-pointed catheter, recommended by Dr. P. H. Watson, will be found far more trustworthy than the small-sized silver instruments, whether uniform or probe-pointed, in common use. With the aid of the hot bath, opiates, or, best of all, chloroform, we may succeed. But, if baffled in this legitimate use of the instrument, we are not warranted in having recourse to force. It is better to cut than to bruise and tear; it is better to make a clean wound, through which urine may discharge itself innocuously, than to leave a bruised and torn sinus, in which infiltration can hardly fail to occur, with all its lamentable results. The patient, under chloroform, is put into the position suitable for Lithotomy, and the stricture staff of Mr. Syme having been carried down to the site of the obstruction, an incision is made in the central raphé, as formerly described, so as to expose the end of the staff sufficiently to enable the surgeon to introduce his finger; by its aid he will then frequently succeed in passing the grooved instrument through the stricture, and thus secure the accurate division of the constricted portion of the canal. Should he fail in carrying on the staff, the incision in the mesial line should be extended backwards, cutting as deeply as the level of the urethra; and thus in most cases the canal will be at once opened, the distended pouch which exists behind the stricture readily permitting the knife to enter it. Now the staff may be at once passed onwards to reach the finger which supports the surface of the stricture posteriorly. But should the surgeon fail in this, a grooved probe may be insinuated from behind; and in the event of this not succeeding, an incision should be carried through the indurated tissue to the requisite depth in the course of the urethra, in the hope of opening the constricted portion of the canal. When the stricture is at the bulb, the urethra may very readily be opened in the membranous part, by passing the fore-finger of the left hand up the rectum, feeling for the tip of the prostate, and, in front of it, the distended urethra. Then carrying a long straight bis-

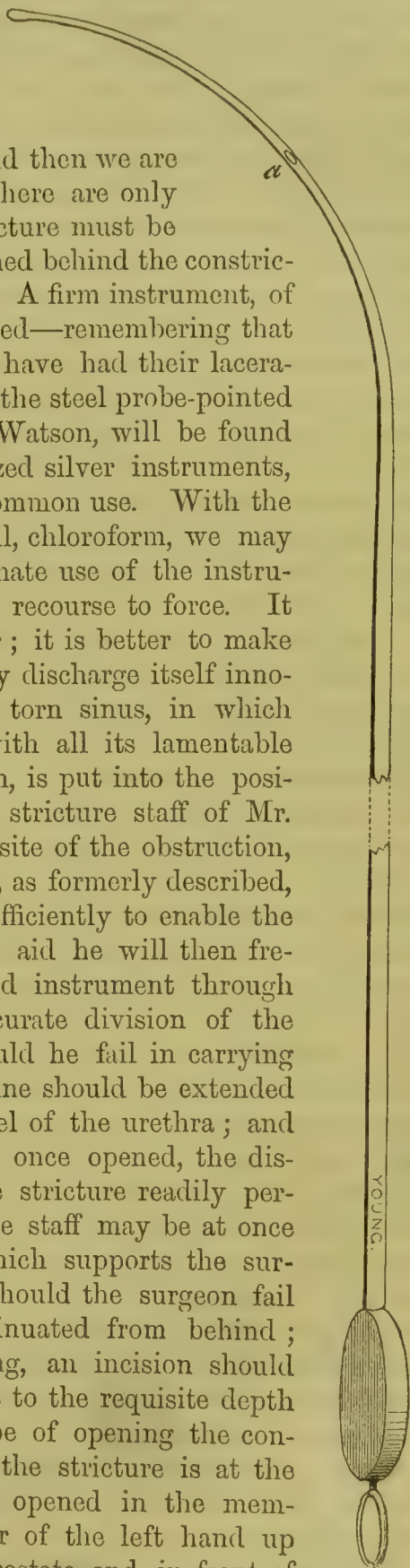


Fig. 341.

Fig. 341. Probe-pointed Catheter.—P. H. WATSON.

toury, with the cutting edge turned forwards, from a point half an inch in front of the anus, directly upwards in the middle line to the tip of the prostate, it is passed into the membranous portion of the urethra ; and as the blade is withdrawn, the external wound is enlarged to the desired extent. After this, the stricture may be passed by the staff and divided at the same time ; a catheter being then introduced into the bladder from the perineal wound, and retained for some days ; and so soon as possible thereafter a bougie of medium size should be passed along the canal from the orifice to the bladder. On cicatrization being nearly completed, the size of the catheter or bougie is gradually increased ; and instrumentation is continued, in the ordinary way, until full dilatation shall have been attained. This is the treatment of extreme cases—complicated with the crisis of retention ; as also of cases of lacerated urethra, recent or of old standing, when the instrument cannot be passed into the bladder by reason of non-correspondence of the torn extremities of the canal—or at a later period when the urine is all passed by fistulæ in perineo, and the anterior portion of the canal at the injured part appears to have become occluded. To such only is it applicable. And of the skilful surgeon it is comparatively seldom required in cases of stricture.

Incision has been practised from within the canal, by the employment of lancetted catheters. But these are dangerous weapons, very obviously, in the hands of the inexperienced ; and the most skilful must have difficulty in using them with safety, in the case of stricture posterior to the scrotum. There can be no certainty of the incision being made in the true direction ; profuse bleeding may ensue ; the parts around and beyond the walls of the canal may be injured ; and then infiltration of urine can hardly fail to follow. These instruments are intended to act upon two different principles ; the one class cutting from before backwards ; the other from behind forwards. Some of the former class have a small guiding director, which is passed through the stricture before the lancet blade, contained in the thick portion of the instrument, is pushed onwards to divide the contraction ; others have the lancet protruded at hap-hazard, trocar-like, from the end of the canula. The former may reasonably be supposed to merit more confidence than the latter ; as they may be employed in light resilient strictures ; and the section of the constriction by them certainly ensures that what is cut serves to increase the calibre of the canal. The latter class of instruments are usually so bulky, that any stricture which will admit their passage can have no need of treatment by incision. After the stricture has been divided by any of these weapons, a full-sized catheter is passed, and retained till the risk of extravasation is past. After this, dilatation by the occasional use of the bougie must be attended to, as these methods of division of stricture have no advantage over the external incision in this respect. An external wound, no doubt, is avoided ; but the operation is less certainly effected, less safe, and more complicated than the method of Mr. Syme.

Orificial stricture may be congenital. In the adult it is usually tight, callous, unyielding, sometimes admitting the most delicate probe with difficulty, and usually the result of the cicatricial contraction of a

chancre situated at the orifice of the urethra. Although by probes, or short bougies, occasionally introduced, a cure by dilatation may sometimes be procured in the ordinary way, it is usually more expeditious and satisfactory to resort to incision. A narrow probe-pointed bistoury is introduced; and, by its edge, the contracted part is divided downwards. A Bowman's probe for the lachrymal canal, or a stricture-probe, grooved upon the lower surface, having been passed, a sharp-pointed curved bistoury, or a tenotomy knife, is employed to effect division of the constricted portion. A full-sized bougie is passed immediately afterwards, and repeated daily; a less interval than usual sufficing here, in consequence of there being less irritability than in the deeper-seated portions of the canal. Sometimes, it may be found necessary to lay the contracted part entirely open by incision, introducing the bougie afterwards through the wound; and seeking for a cure of the stricture, at the cost of establishing a slightly imperfect state of the urethra, similar to the congenital malformation termed *Hypospadias*.

Analogous to internal section of the canal, by cutting instruments passed along the constricted part, but attended with less extensive injury—calculated to induce profuse hemorrhage, or risk the occurrence of urinary extravasation—various plans have been devised for lacerating or splitting up the contracted portion of the canal. The great obstacle to effecting this satisfactorily, must ever be the difficulty of introducing an instrument which combines at once slenderness with strength. Rapid, or forcible dilatation of the canal, by the passage in immediate succession of one bougie after another, has been long known as a means by which this might be effected. The difficulty, however, of introducing the common bougie in gradually increasing size, through a tight stricture, without failure, has been so well recognised, that conical or tapering instruments, of four or five different sizes, shaped like a bougie, and the smaller ones terminating in a probe-point, have been recommended. By others, a steel instrument, with a small extremity and tapering shaft, and with a projecting wedge-shaped blunted flange, has been recommended (Marshall). By others, a guiding catheter, and different sizes of flexible tubes passed one after the other, have been recommended (Wakley). While others employ instruments formed of expanding blades, acted on either by means of a screw (Perrève), or by conical tubes sliding on a guiding rod (Holt), in order to effect the longitudinal splitting up of the constricted portion of the canal. When this has been effected—under chloroform—a catheter is passed and retained for some days. The great objection to these instruments is, that their large size requires a stricture to be comparatively very slight in degree, or already well dilated before they can be employed.

It is easy to understand how spontaneous alleviation of stricture may occur; either by absorption, or by ulceration. But it is probable that such an occurrence is actually very rare; and, certainly, it is not to be trusted to in practice. Relief by the latter mode, indeed, is scarcely desirable; inasmuch as the cicatrix of the ulcer is likely to reproduce contraction, perhaps in an aggravated form.

For a like reason, the caustic bougie has fallen into comparative desuetude. To prove successful as an escharotic, in clearing away obstruction, the mucous membrane must first be sacrificed; and though, for

a time, ample space may be thus obtained, yet in the end recontraction is obviously inevitable ; partly by reason of the plastic product which surrounds ulceration, and partly by reason of the contraction which invariably attends on cicatrization of a sore. Probably the best use of the "caustic bougie" is, not as an escharotic, but as a corrector of irritability. If a peculiarly irritable stricture resist the ordinary means, already alluded to, decided benefit may be obtained by the application of nitrate of silver to the contracted part and its vicinity. This may be accomplished, either by the *porte-caustique*, recommended by M. Lallemand ; or by means of the old-fashioned instrument—a wax bougie, in whose hollowed point a portion of the nitrate is imbedded. For a stricture at all penetrable, the former is preferable ; but a tight contraction can be directly reached only by the latter mode of conveyance.

Instead of nitrate of silver, caustic potass is used by some ; not as an escharotic, but as an "alterative."* A small portion—from a grain to the eighth of a grain—having been inserted in a hole made in the point of a soft bougie, is passed rapidly down to the stricture, and held there for one, two, or three minutes ; and repetition is made in four or five days, after irritation has passed away. A piece of soap, however, might probably produce quite as satisfactory effects as the eighth of a grain of potash, among so much oil as requires to be used in this procedure.

In retrospect of what has been said as to the treatment of stricture, we may recapitulate.

1. Treatment should in all cases first consist of the use of bougies, upon the principle of vital dilatation.

2. In cases of tight stricture, seen for the first time during an attack of retention, the catheter passed may be very advantageously tied in, and permanent dilatation practised for a day or two, so as to gain space rapidly.

3. "Vital dilatation" or "tunnelling" need not be used when the passage of the bougie, however small, can be effected ; but, otherwise, good practice may be made in this way.

4. Treatment by external incision is suited to "resilient," obstinate, irritable strictures ; and to cases of very tight stricture, when it is of importance to make rapid progress.

5. Opening the urethra behind the seat of constriction should never be adopted when a grooved staff can be insinuated along the constricted part of the canal. It is suited, however, for cases of completely obstructed urethra from any of the causes before mentioned.

6. The ingenious devices for splitting up a stricture are rarely to be employed ; division by the knife being preferred.

7. Division of stricture from within is not superior to the external operation.

Urinous Abscess.

This consists in the condition of abscess, complicated with a communication with the bladder or urethra, and consequently having a greater or less admixture of urine in its contents. The formation may occur in

* Wade on Stricture, Lond. 1849.

one of two ways ; from without or from within. 1. An abscess may form exteriorly to the urinary passages—excited by injury, by urethritis, by the irritation of stricture, or by the presence of a stone ; and, in its progress by enlargement, it may open into the urethra, or, when commencing in the prostatic tissues, into the bladder. Then, through the aperture by which the purulent contents escape, urine enters. Its stimulus, within the purulent cyst, necessarily kindles a fresh amount of inflammatory mischief. If any obstruction exist in front to the free escape of urine, the distended sac may give way, and urinous infiltration takes place into the surrounding tissues, which, unless relieved by timely incision, are sure to slough. But if the abscess-sac continues entire, then the escaped urine remains limited within the original cavity, and the state of urinous abscess is established. The collection may assume quite a chronic character ; but, in general, it extends more rapidly than an ordinary acute abscess—hastening to the surface, and discharging thin, dark-coloured, and foetid contents.

2. Sometimes, as already remarked, the affection originates in ulceration of the lining membrane of the urethra. Acute ulceration, and also direct laceration, of the mucous membrane is liable to occur, as we have seen, in the case of retention of urine ; then rapid escape of that fluid takes place, under powerful action of the hypertrophied muscle of the bladder ; and the most formidable extravasation results. But, unconnected with any such crisis, a more gradual giving way may take place ; the urine, escaping first in a few drops, may excite an inflammatory process ; the abscess formed has all the ordinary characters—the important limiting barrier of organized lymph not excepted ; and, as it enlarges, these are not destroyed. Before the actual ulceration, too, it is probable that an inflammatory process has been slowly advancing in the tissue exterior ; which has thus become in some measure consolidated, before any urine has had an opportunity of entrance.

Or, as has already been stated, the commencement may not be by ulceration, but by wound or tear—inflicted by an unskilful use of catheters, bougies, or other instruments.

When ulceration is the cause, it may be either immediately behind the stricture, or at some distance posteriorly. The ordinary site is in the perineum. There a hard swelling is discovered, on pressure ; the ordinary symptoms of stricture undergo aggravation ; shivering and febrile disturbance occur ; and, perhaps, by the pressure of the abscess, retention of urine may be occasioned. Treatment consists in making a free external incision, for the evacuation of matter and urine ; treating the cause, the stricture, either in the ordinary way by dilatation afterwards, or by dividing the stricture upon a grooved staff at the same time.

Urinary Fistula.

This may follow wound in the perineum, implicating the urethra. More frequently, it is the result of urinous abscess. The collection has opened spontaneously in the perineum, temporarily relieving the symptoms, both of abscess and of stricture ; but, by persistence of the latter, the healing of the abscess is prevented ; the irritation of the stricture

maintains a morbid degree of excitement, and the obstruction which it occasions forces the urine into the abnormal channel. The abscess consequently does not close; but partially contracting, degenerates into the condition of fistula. There may be but one fistula, or several; in the perineum, or traversing the scrotum, or anterior to the scrotum, or on the nates. Sometimes abscess burrows beneath the fascia of the penis, and opens near the glans; sometimes the opening is on the dorsum of the penis. Also, one abscess, having more than one external outlet, may lead to the establishment of more than one fistula; or, each fistulous opening may be connected with a separate abscess. Sometimes the fistula opens into the rectum, sometimes upon the inner side of the thigh. I have seen two openings, through which the greater part of the urine issued, situated, one in the groin, the other in the middle of the thigh. In some cases, when the communication with the urinary canal has existed close to the prostate, more usually, however, with the urethra in front of the triangular ligament, the opening externally forms in the perineum, which becomes reddened, callous, and perforated with apertures, and studded with papillary elevations, from which urine and discharge constantly distil. The discharge is thin and glecty; often copious, often containing seminal fluid. Sometimes a constant dribbling of urine exists; in other cases, urine escapes only during an expulsive effort. The surrounding parts are tender and excoriated; the patient is in a constant state of discomfort, and possesses an urinous, or a peculiar "mousey smell," which is pathognomonic; very frequently the general health suffers seriously.

Treatment is simple; directed to the stricture, not to the fistula—at least in the first instance. The stricture having been thoroughly dilated, the urine comes again by the normal channel; the fistula contracts and dries; and, in many cases, it wholly closes, without any direct treatment having been received. Should contraction prove tedious and incomplete, the hot wire may be used; applied not to the mere orifice, but deep in the track—lest premature closure of the external part might take place; not repeated frequently, but at long intervals—it being our object to obtain the benefit of the healing process which follows remotely on the burn, not the destructive and inflammatory effects which are its primary result. The galvanic cautery has also been satisfactorily employed for this purpose. If sinuses communicate with fistulæ, it will probably be necessary to lay them open with the bistoury. In cases long neglected, in which the whole urine has for years been passing by the perineum, the constricted portion of the urethra anterior to the opening contracts greatly, and may be almost completely obliterated. Dilatation is then effected with great difficulty; and recourse to the method by incision will probably be expedient, without subjecting the patient to the delay involved by the use of less efficient means.

Sometimes the abscess opens, not in the perineum, but into the rectum; and fistula forms in the bowel. Urine passes per anum; and air, or even fæces, may escape by the urethra. Treatment is the same as for the more common varieties; the speculum ani being used to protect the bowel, when it is necessary to employ the cautery. When the fistulous track is due to prostatic abscess, and communicates through the

prostate with the rectum and bladder, the results of treatment are almost certain to prove unsatisfactory, especially when the disease occurs in a scrofulous patient. A median lithotomy incision, with section of the prostate, and the introduction of a tube, retained for some days, seems to afford greater likelihood of affording a complete restoration of the parts to a healthy condition than any less decided measure. When disease of the vesiculæ, however, co-exists, and peritoneal symptoms have from time to time threatened to terminate in peritonitis, the less interference of an operative kind, the better for the patient.

Laceration of the Urethra.

This, as has been already said, may be produced by a blow, a kick, or a fall. In some cases it accompanies fracture of the pelvis ; in others, where the pelvic bones have not given way, they seem to have yielded, so that the triangular ligament appears to be the active agent in lacerating the urethra. The lesion in the last-mentioned case usually occurs at the membranous portion of the canal ; in the others, at the point directly acted upon by the agent causing the tear. Pain, escape of blood from the urethra, and an inability to micturite, with swelling in the perineum, occasioned by extravasation of blood, usually characterize the injury. It should be a rule, in all such cases, to make sure of the condition of the urethra when called to see the patient ; at once passing a catheter, drawing off the urine, and thus avoiding all risk of extravasation. If the catheter is easily passed, it may be withdrawn, and passed again from time to time as required ; but if it is with difficulty introduced, or the patient lives at some distance, it should be retained for a day or two. If a catheter cannot be passed, incision upon a grooved staff passed down as far as possible, and maintained in the middle line of the perineum, must be had recourse to, as already explained ; the proximal end of the urethra is then sought for, and a catheter carried into the bladder from the perineal wound. But extravasation of urine is not the only risk that demands our regard. On opening the perineum, a large coagulum will often be found surrounding the urethra, and distending the deep fascia ; on clearing this away, very copious hemorrhage sometimes ensues, proceeding, in most cases, from the artery of the bulb, which should be secured ; the incision being extended to a sufficient degree to admit of this being satisfactorily effected. Where a catheter has been introduced without having recourse to incision, the risk of suppuration ensuing is great ; due both to the presence of some extravasated blood, and also to the escape of a little urine by the side of the catheter finding its way into the laceration. The abscess so formed, having been opened, usually degenerates into perineal fistula. Even if this does not occur, the portion of the canal at the site of injury, whether partially or completely lacerated, will usually, in healing, undergo contraction ; unless, by the employment of bougies, this disposition to the formation of stricture is frustrated. Leeching, fomentation, rest, and antiphlogistic regimen, are therefore very essential after the injury. Neglect a severe kick or blow of the perineum, and stricture, abscess, and fistula, are almost sure to follow.

CHAPTER LXII.

AFFECTIONS OF THE TESTICLE.

Orchitis.

THE inflammatory process affecting the testicle may be acute or chronic ; original, as following external injury ; or a mere complication, the consequence or attendant of gonorrhœa. Sometimes it is a complication of Variola, or of Mumps—inflammatory enlargement of the glands in the upper part of the neck ; then usually affecting the gland or its fibrous covering, and not improbably depending on metastasis.

Gonorrhœal orchitis, or *Epididymitis*, as it should more properly be called, is usually acute, and is the most frequent form of the affection. It is also known as gonorrhœal swelled testicle, or as vaginalitis, or by the absurd title of *Hernia humoralis*. There being an increased susceptibility in all the genital system, during the existence of gonorrhœa, orchitis may be lighted up at any time, by the application of a slight exciting cause ; as a squeeze, excess in walking or diet, exposure to cold and wet, or premature use of strong injection. But, without any apparent exciting cause, the attack very commonly occurs ; and seldom until some time has elapsed—usually from the fourth to the sixth or eighth week of the gonorrhœa—the inflammatory process having had time gradually to creep backwards to the prostatic portion of the canal and orifices of the ejaculatory ducts. The gonorrhœal form is never the result of metastasis ; the affection always extends by continuity of tissue, descending

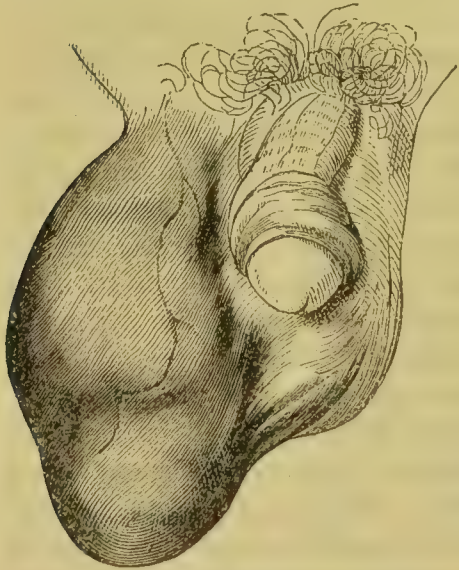


Fig. 342.

along the vas deferens, which is usually painful before the inflammatory process seizes on the epididymis, and takes up its abode there. The affection should, therefore, in strict language be designated as an Epididymitis ; and the swelling of the whole testicle, which seems to occur, really depends on acute accumulation of serum in the tunica vaginalis. The occurrence of epididymitis has by some been too largely attributed to the employment of injections. No doubt the premature use of strong and irritating fluids, injected forcibly along the canal, may

Fig. 342. Acute orchitis ; attendant on gonorrhœa.

tend to propagate the inflammatory process more rapidly backwards towards the prostate than would have occurred spontaneously, yet there seems no good reason, but rather the contrary, to blame injections—rightly used—as a cause of the swelling and irritation; for by their judicious use, at the proper time, along with the employment of acute anti-gonorrhœal remedies at an early period of the disease, the inflammatory symptoms will disappear, discharge will cease, and the affection of the epididymis will be prevented. By some a large and pendulous scrotum has been believed to favour the occurrence of this affection; and the more dependent position of the left testicle has been supposed to favour a predisposition to its suffering more frequently than its fellow. Support of the testicles during the existence of a gonorrhœa or gleet is certainly a valuable precautionary measure; but not only are the testicles equally liable, apparently, to suffer from the inflammatory access, but an undescended testis in the abdomen, or inguinal canal, may become affected, while the pendulous organ on the other side remains undisturbed. These glands sometimes suffer together; in other cases consecutively; or the attack may pass backwards and forwards between the two.

Pain and a sense of weight are felt in the cord and testicle, the skin reddens, and uneasiness is complained of in the groin and loins. Sometimes the attack is sudden, in other cases it is gradual in its access. These symptoms are usually preceded by a sense of uneasiness at the fundament, and frequent desire to make water. The swelling and pain increase, often becoming excruciating; and then sensation in the loins is as if the back were sawn across. Discharge from the urethra diminishes, and ceases—an example not of metastasis, but of the effect of counter-irritation. The scrotal swelling becomes tense, red, glistening, and intolerant of the slightest pressure; the cord, too, is swollen, red, and painful. Febrile disturbance is considerable; and vomiting is both a common and distressing symptom. Sometimes such pain is complained of in the lower part of the abdomen, as, along with the vomiting, to lead to a simulation of enteritis, of internal strangulation, or—when the affected testicle occupies the inguinal canal—of strangulated hernia; and for this the complaint has actually been mistaken. During the progress of gonorrhœal epididymitis, seminal emissions are liable to occur, sometimes as a precursor of the attack, more usually during its progress. The seminal secretion is, in such circumstances, usually mingled with more or less blood and purulent matter.

Treatment.—At the very outset of a case of epididymitis, a smart emetic will frequently serve to cut short the impending inflammatory access; but when hardness of the epididymis and swelling of the cord, with effusion of fluid into the tunica vaginalis, have already occurred, this will no longer serve any good purpose. By many the restoration of discharge from the urethra is what is aimed at; and stimulating injections, the application of gonorrhœal matter, or of red oxide of mercury ointment smeared on a bougie, or repetition of sexual intercourse with a subject likely to communicate a new irritation of the urethral mucous membrane, have not only been recommended but employed. Such expedients are here mentioned only to reprobate their use, which is by no means likely

to do good, and may do much harm ; for the returning urethral discharge which accompanies a recedence of the scrotal inflammatory process, is not the cause but the consequence of its departure. Leeching of the scrotum, bleeding from the arm, or opening veins in the scrotal surface by puncture or scarification, are all unsatisfactory ; weakening the patient, and not commensurately relieving the pain or tension, or cutting short the attack. Hot acetate of lead and opium fomentations, followed by mercurial ointment mixed with a quarter of its bulk of extract of belladonna—the testicle at the same time being thoroughly supported—will be found of far greater benefit ; while opiates internally may be administered by the mouth or rectum, if the pain is very intense. Laxatives, not purgatives, should be given as required. The diet should be stinted ; the patient should lie in bed, or on the sofa ; and Mindererus' spirit, or antimony, may be employed when the inflammatory condition seems to require the use of some gentle contrastimulant. If tension be great, it is well to puncture the tunica vaginalis with the lancet, so as to evacuate the accumulated serum. Vidal de Cassis has advised that the puncture should divide the fibrous tunic of the testis ; but this does not seem necessary, the testis seldom being at all affected. As the trouble subsides, resolution may be hastened by stimulants to absorption ; a solution of the iodide of potassium, with iodine, may be painted on the surface, and pushed to vesication ; at a more advanced period, a gum and mercurial plaster may be applied ; or pressure may be made by means of adhesive plaster, cut in strips, and applied as if to a limb—the testicle being separated from its fellow, and made to protrude, so as to admit of such application. Ricord at one time proposed to apply this pressure from the first ; but, surely, its proper place is only after the chronic stage has been fairly established. In the acute stage, pressure, however carefully applied, is likely to prove intolerable, or at least to cause aggravation, if the disease be resident in the testicle itself.

As the complaint yields, discharge may be expected to reappear at the orifice of the urethra. Very frequently, resolution is incomplete ; hardness and swelling remaining in the epididymis ; and so long as these exist, the function of the affected testis must be considered as in abeyance. Thus after double epididymitis, although sexual intercourse can occur as before, fecundation cannot take place. In such circumstances the ejaculated fluid is found destitute of spermatozoa. This condition requires active perseverance in the employment of local discutients ; and the iodide of potassium may be useful internally. In some rare cases, resolute absorption is not only rapid but excessive. The gland, after regaining the normal size, continues to diminish, and may ultimately dwindle down to a mere shred, wholly destitute of the peculiar function. On the other hand, sloughing of the gland has sometimes resulted from the acuteness of the inflammatory progress.

Sometimes *Abscess* forms ; but seldom in the gonorrhoeal form, unless some casualty or mismanagement have occurred, involving the testis, as well as the epididymis. In traumatic orchitis, however, the occurrence is not so rare. It is attended with much suffering ; and the tubular structure of the organ is endangered. An incision must be made as soon as matter has formed ; and, in the after treatment, care must be taken

to obviate the tendency to fungous protrusion which the substance of the testicle may manifest.

Chronic Orchitis, and Fungus of the Testicle.

Chronic orchitis may be the result of an acute attack, imperfectly resolved ; or—as more frequently happens—the affection may be chronic from the first ; it also may be either primary or secondary—that is, occurring as an independent affection, or as a consequence of gonorrhœa. Very frequently, it depends on stricture of the urethra ; not unfrequently it is of syphilitic origin. The body of the testicle is completely involved, as well as the epididymis—though the latter is usually first affected. The swelling, at first irregular, extends from the lower part of the epididymis, and involves the whole organ in a firm, inelastic, uniform tumour, usually of an oval form, and seldom exceeding twice or three times the bulk of the healthy gland. The attendant uneasiness is slight ; and after some time, the characteristic sensibility of the organ under pressure is in a great measure lost.

The enlargement is found to depend in part on the formation of a yellow, cheesy, fibrinous, or purulent product ; condensed, non-vascular—intra-tubular, as well as in the interposed areolar tissue. On making a section of the tumour, after removal, the product and its peculiar characters are very apparent.

Slow softening of this may take place ; matter is formed ; the swelling increases, with subacute exacerbation ; the integument thins, and gives way ; and through the opening the tubular structure protrudes, in the form of a hard, firm, light-coloured, comparatively painless, and slowly increasing fungus. The softening, in such a case, is but partial, and the amount of suppuration slight. Not unfrequently, opening and protrusion take place apparently without the intervention of any such affection ; the tunica albuginea gives way, under gradual increase of product ; the tunica vaginalis becomes adherent at this point ; and then the integument soon yields also. If the opening be small, the protrusion may be proportionally trifling. But, sometimes, almost the whole of the organ projects ; its surface studded with granulations, from which a copious thin secretion is discharged.

Chronic orchitis requires the ordinary discussive means for its arrest and removal ; and abstraction of the cause, when practicable, is not to be omitted. Simple enlargements of the testicle always lead to a suspicion of stricture in the urethra ; and that canal is examined accordingly. If the stricture be found, it must be removed, before any amendment can be expected from treatment directed towards the testicle. When syphilis is the originating cause—indicated by the history of the case, moderate size, and slow progress of the tumour, the concurrence of other syphilitic signs, and sometimes by nocturnal exacerbations of pain in the testicle and loins—that taint must be combated by the appropriate means ; and cautious mercurialism may be required. The enlarged testicle, meanwhile, may be treated most advantageously by being surrounded by a gum and mercurial plaster ; thereafter, producing steady encircling pressure, either by a narrow bandage, or by strips of adhesive plaster.

Between English and French authors the subject of syphilitic sarcocele is a matter of dispute. By the former, two forms are admitted :—

1. The ovoid enlargement, never exceeding the size of the fist, frequently combined with a chronic collection of fluid in the tunica vaginalis, commencing in a tubercular affection of the tunica albuginea testis, and never implicating the epididymis. These separate knots or small tubercles, as they progress, coalesce, so that when the affection has advanced, even in a moderate degree, their existence cannot be made out. Having attained a moderate bulk, this form of albuginitis recedes, and the testis is either restored to its normal size or becomes atrophied. Suppuration never occurs in this form of the disease.
2. The second variety—which French surgeons do not for the most part acknowledge to be a disease of the testis at all, but simply gummata which have become adherent to the tunica albuginea testis—commences as a bosselated mass of very irregular surface, which terminates in softening, implication of the skin, evacuation of a gummy purulent matter by several openings, and in restoration of the organ more or less completely to its normal condition ; sometimes, however, followed by protrusion of the whole organ through one of the apertures. The former affection belongs to the transitional period of the syphilitic infection ; the latter to the true and advanced tertiary stage of the disease. Both are to be carefully distinguished from medullary disease, from the scrofulous testicle, and from the gonorrhœal affection of the epididymis. The entire absence of all participation of the cord and epididymis, the comparatively painless progress of the disease, the period of life of the patient, the history of the syphilitic infection, together with the anatomical characteristics of the disease already given, should prevent any mistakes being committed. In the early form mercurials are appropriate, more especially bichloride of mercury dissolved in a solution of iodide of potassium. In the later tertiary form, iodide of potassium alone suffices. The early form, although rarely suppurating, sometimes has terminated in a local softening ; matter forming and being evacuated ; and in such cases a true fungus testis has in several instances been recognised protruding like a sessile mushroom from the aperture. In the later form, protrusion of the tubular texture of the testis never occurs ; the surface of the tunica albuginea alone being exposed in the bottom of the opening.

In the open condition of sarcocele, when fungus, from any cause, has formed, a slight operation is usually necessary ; the object being to reclaim the fungus—producing absorption of the abnormal product, reducing the swelling, and clearing the tubuli. The thickened integument around, constituting the closely adherent margin of the ulcerated opening, is loosened by dissection ; and, having been brought completely over the protrusion, is secured by suture. Consolidation takes place ; partly by the first, but mainly by the second intention ; tendency to protrusion is repressed ; and, by the contraction incidental to cicatrization, such pressure is exerted by the integument on the parts beneath, as leads to gradual removal, at least in part, of the abnormal structure. After cicatrization, such pressure may be supposed to continue, in some degree, for a time ; and is then to be aided by the discussive means applicable to occult chronic enlargements. When the affection is due to syphilis, the iodide

of potassium will be found most serviceable, either with or after the use of mercurials. In the tertiary form, when the testis protrudes, or is exposed through one or more openings, mere local stimulation, with the administration of some preparation of iodine, is all that is requisite.

The restoration of the protruding fungus testis is infinitely preferable to the old method of shaving off the protrusion from time to time, and treating the remaining wound as an ordinary ulcer. The cure was tedious; and, besides, frequent use of the knife in this way was tantamount to castration. By the new method—for which the profession is chiefly indebted to Mr. Syme*—cure is accelerated, and the function of the testicle is preserved. A question, however, still remains to be settled: whether the whole of the protruded part is capable of being reclaimed; whether the intra-tubular product will wholly disappear, and the tubes everywhere recover their normal state and function. The probability is that, in the outward part of the fungus, disorganization has often advanced too far to admit of this; and that, therefore, this portion—seldom more than a thin slice—may be removed by the knife, before the rest is covered in by raised integument, without sacrificing any recoverable virile power, and with the effect of still further expediting the cure. Often, the operation cannot be performed immediately on the patient's presenting himself; some days of preparatory treatment are usually necessary, that the part may be brought to a clean, granulating, and quiet condition—favourable to adhesive results.

Central suppuration may occur in chronic orchitis. The matter may slowly reach the surface, and be discharged. Sometimes, it remains long stationary, in the condition of chronic abscess. Then the fluid portion of the matter may be absorbed, while the solid part remains in a concrete mass, resembling tubercular product; but distinguished from it, by being confined within a distinct cyst—what was the pyogenic membrane.

Scrofulous Testicle.

Tubercular product is not uncommon in the testicle; occurring either in aggregated masses, or diffused in the tubular structure, which becomes atrophied under the pressure of accumulation. Such affection is termed "*Scrofulous Testicle*." The swelling is gradual and very indolent; little pain or uneasiness is felt; the tumour seldom attains to a large size; and the tubercular diathesis is usually indicated by strumous affections in other parts of the body. After a time, one of the prominences enlarges, reddens, and becomes painful; softening and suppuration have occurred there; the integument gives way, and pus and tubercular matter are discharged. The sore presents the ordinary appearances consequent on tubercular softening. Other parts may soften, point, and break; and sinuses communicate one with another. After a time, the greater part of the tubercular matter may be discharged; then the swelling diminishes, and the sores assume a healing tendency. Should any considerable part of the tubular structure have remained entire, it may protrude and form a fungus, as in the case of simple chronic orchitis.

* Contributions to Surgery, p. 204, Edin. 1848.

tis. This fungus may be repressed in the ordinary way ; and solid and permanent cicatrization may occur. But, sometimes, a fistulous opening remains, discharging thin pus, with occasionally also the secretion of the tubuli ; and then the condition of *Spermatic Fistula* is said to be established.

Treatment varies according to the stage of advancement. In the indolent state, discussives are employed, along with antistrumous constitutional treatment ; and gradual subsidence of the swelling may result. In the softened state, incision is suitable ; for evacuation. If then the amount of product and suppuration seem slight, cicatrization is to be attempted. If, however, as is more frequently the case, suppuration and product are extensive, it is well to favour speedy disintegration and discharge of the abnormal mass, by free use of the caustic potass. Afterwards, pressure, by strapping, is of much use in procuring closure and cure. Sometimes, the tubercular matter protrudes slightly ; but this is readily distinguished from the true fungus which is composed of the substance of the gland, by being of less size, soft, crumbling, varying, temporary, and requiring the destructive use of an escharotic. Sometimes the extent of suppuration and disorganization in the part, and the degree of disturbance in the constitution, are such as to call for more summary procedure ; and to save gradual exhaustion of the system by hectic, the part has to be sacrificed, by castration. This, however, is to be avoided if possible ; as, very frequently, the other testicle becomes similarly affected. And the disease, moreover, is liable to develop itself in other sites—as in the prostate gland, and the lungs.

In the indolent stage of scrofulous testicle, and during the progress of simple enlargement dependent on chronic orchitis, it is not uncommon for serum to accumulate in greater or less quantity ; masking the character of the tumour, and increasing its apparent bulk. It is detected by its site, extent, translucency, and fluctuation. If the accumulation prove considerable, occasional removal by tapping is of use ; permitting the discussive applications to act more efficiently on the solid enlargement.

Tumours of the Testicle.

These were wont to be included under the general term *Sarcocoele*. The most common is the simple enlargement dependent on chronic orchitis. The scrofulous swelling is not uncommon. Occasionally the fibrous tumour is found. Cystic sarcoma is as frequently formed here as in any other situation. Scirrhus, open or occult, is not of common occurrence. Medullary cancer has no more frequent site ; sometimes, though rarely, it is combined with melanosis ; and sometimes the open medullary tumour degenerates into the condition of *Fungus Hæmatodes*.

These tumours present the ordinary characters, and require the ordinary treatment. The simple enlargements are capable of discussion. The strumous may be either discussed or disintegrated. The rest can be removed only by castration. Prognosis, in the case of malignant formations, may be more favourable here than at any other site.

Irritable Testicle.

This term is usually made to include mere increase of the sensibility of the organ, as well as decided neuralgia. The former is almost always dependent on some affection of the urethra, bladder, or kidney, or on disorder of the general system; and is to be remedied accordingly. But it may—like the tumid and sensitive breast of the female—be the temporary consequence of change at puberty; and it may also follow mere excess in venereal excitement.

It is a formidable disease; inasmuch as it is attended with great suffering, and is but little amenable to any treatment. Uneasiness is almost constant, the part is tender to the touch, and violent pain comes in paroxysms. There is little or no enlargement, or other morbid indication in the organ; in general, it is intolerant of pressure and manipulation; and, during the paroxysm, it is retracted close upon the groin. The patients most liable to suffer from such affections are the weak, nervous, dyspeptic, and the subjects of oxaluria, more especially if they have indulged in venereal excess. Occasionally the affection is combined with cirsocele; and seems to depend on that morbid condition of the veins. But, in general, the origin of the affection is equally obscure as in most other cases of neuralgia. The treatment is such as is generally applicable to this disease. Among the more successful local applications, aconite, belladonna, and nitrate of silver, may be mentioned; among those used internally, iron, and the liquor arsenicalis. Frequently but little improvement follows the most skilful management; and the patient may be driven by his sufferings to demand castration. This request is seldom if ever to be complied with, however; inasmuch as the neuralgia is likely to return, in the cord, or other testis; being not dependent on any local cause capable of being removed by the operation.

Atrophy of the Testicle.

Gradual wasting of the testicle may follow acute orchitis, as already noticed; and a blow or squeeze may result in this, with the intervention of a slight inflammatory process.* It is not uncommon for atrophy of the testicle to supervene on cirsocele. The pressure of hydrocele, too, would appear, in some few cases, to cause diminution of the gland; and the same result has followed the pressure of fatty or other tumours. Continence, and the prolonged use of iodine internally, are supposed to tend to atrophy; but the truth of the supposition seems more than doubtful. In most cases where atrophy has followed the use of iodine, it has been due to preliminary disorganization of the secretory structure of the gland, effected by the pressure of some chronic product of an inflammatory or syphilitic type. Suppuration of the testicle may cause loss of part of the tubular structure, with obstruction and consequent absorption of the remainder. Atrophy of one or both organs, it has been

* Squeezing of the testicles is a mode of castration in oriental courts; complete atrophy being found to result. And the same method is applied to the lower animals; bucks for example.

supposed, has followed injuries of the head. Occasionally, examples of the affection occur while no exciting cause can be assigned.

Obviously, but little is in our power in the way of treatment; except by removal of the cause, when that is practicable. In the case of cirsocele, for example, if we succeed in curing this, wasting of the testicle may be expected to cease. Restoration of the normal bulk, however, is scarcely probable. Atrophy of one testicle is fortunately a matter of no consequence, as it does not influence the virility of the individual in the slightest degree.

Hydrocele.

The term denotes chronic accumulation of serum, in connection with the genital organs; and this may occur in more than one site; in the tunica vaginalis, in the cord, or in the sac of a hernia.

I. *Hydrocele of the Tunica Vaginalis Testis.*—There is no more common disease. It may follow on injury, and a minor amount of orchitis; sometimes it is attributed by the patient to a strain; very frequently there is no assignable cause. Swelling takes place slowly, and with little or no uneasiness; ascending from the lower part of the scrotum upwards. The tumour may ultimately attain to a large size, encroaching closely on the groin. It is of a pyriform shape, except when much distended; and then the narrowness of the upper part is undone by expansion there. It is translucent, unless the coverings be preternaturally thickened. Fluctuation can be felt, unless distension is great. The testicle usually occupies the back of the cavity, near the middle—nearer the lower than the upper part; and seldom can be felt distinctly. On grasping the tumour firmly at that part, however, a hard substance may be felt; and the patient experiences the peculiar sensation which compression of the testicle is calculated to produce. However translucent the rest of the swelling, at that part it is opaque. Sometimes the testicle is situate in front; and then can be felt distinctly. It is never found at the lower part of the scrotum, and separate from the general swelling, as in hernia. The finger and thumb can always be carried above the tumour, at its neck; and the spermatic cord can be felt free. The tumour has no impulse afforded to it, on coughing, or during any other exertion of the abdominal muscles; unless there be a communication between the cavity of the tunica vaginalis, and that of the abdominal peritoneum—as in the case of congenital hernia. The accumulation generally consists of a straw-coloured serum; and sometimes loose solid bodies are found, as in serous cysts elsewhere. The tunica vaginalis is, in general, merely distended; sometimes it is thickened; sometimes it is intersected, so as to constitute minor cysts. In simple hydrocele, the testicle and epididymis are structurally sound. Not unfrequently, however, they are the subject of chronic enlargement; and then the disease is technically termed *Hydro-sarcocele*.

The treatment of hydrocele is either palliative or radical. The former consists in simply withdrawing the fluid, by tapping; the swelling and uneasiness are removed for a time; but they return, and sometimes

rapidly. The latter treatment consists in withdrawing the serum, and injecting a stimulant fluid instead, whereby a mild inflammatory process may be established, whose resolution, when complete, shall have the effect of restoring the normal balance between exhalation and absorption. Simple tapping may be performed by the thrust of a lancet; the flat end of a probe being afterwards used to keep the wound open, during the flow of serum, if necessary. Or a small exploring trocar and canula may be employed.

When injection is contemplated, a medium-sized trocar and canula are to be preferred. The patient is placed erect. The surgeon, grasping the tumour firmly behind, with his left hand, renders it tense and prominent in front; then the instrument is entered, perpendicularly; afterwards, it is passed obliquely upwards, so as to avoid wound of the testicle, and yet taking care that the obliquity is not such as endangers separation of the coverings of the sac, and non-entrance into the sac itself. The serum having been withdrawn, a syringe is adapted to the canula, and the



Fig. 343.

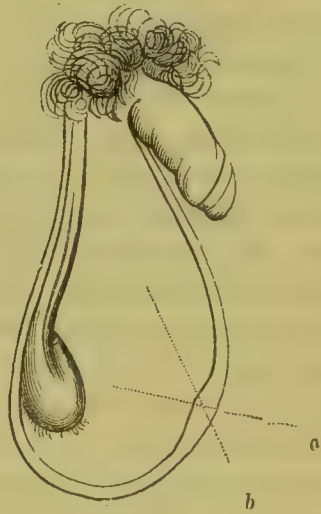


Fig. 344.

cavity is partially filled with some stimulant fluid. Port wine, undiluted, or a solution of the sulphate of zinc, used to be much employed. Now, the injection of iodine is alone used; the pure tincture of iodine being thrown in, and permitted to remain permanently in the sac—disappearing ultimately by absorption.* After a few seconds, the patient will

* Iodine injection was first used by Dr. J. R. Martin of India. The form employed was 3j of tincture of iodine to 3iii of water. Of this, in ordinary hydroceles, a small syringe-ful was injected and retained; in large swellings, two syringe-fuls were used. His experience extended over upwards of 2000 cases in the Native Hospital, Calcutta, and failures were under one per cent. His first operation was in

Fig. 343. Operation of tapping hydrocele; the trocar entering.

Fig. 344. Diagram shewing the direction of the trocar; *a*, the direction of perforating, to avoid splitting of the parietes; the direction afterwards changed to *b*, to avoid wound of the testicle.

begin to feel pain in the testicle, shooting up the cord into the loins ; and a sensation of faintness will probably come upon him. It is time then to put him to bed, with the scrotum supported. If the subsequent inflammatory process threaten to be excessive, fomentation is applied, and the tumid scrotum is supported by means of a silk handkerchief. The serous product, in all cases, re-forms quickly, with heat and pain ; the re-accumulation seeming greater than the first. By and by, however, recession gradually occurs ; the swelling subsides ; the pain ceases ; and, in eight or ten days, we may expect to find the parts restored, permanently, to their normal state. It has been proposed to retap, for evacuation of the acutely formed serum, and thus to abridge the period of cure ; but this seems to be unnecessary.

It is very seldom that the operation fails. Should it do so, it is to be repeated, with a stronger stimulant. The quantity of tincture of iodine which should be injected varies with the size of the sac, from one to three drachms.

Before injecting any stimulant, the surgeon should always be sure that the point of the canula is fully within the cavity of the tunica vaginalis ; otherwise, injection of the areolar tissue of the scrotum may take place—a matter of some importance in the days when port wine was used, as such a mistake has been followed by sloughing, and severe constitutional disturbance.

A case of hydrocele presenting itself, injection cannot at once be determined on. It is first necessary to ascertain whether the testicle is sound or not ; and this cannot be done until the serum has been discharged. If the organ be then found in its normal state, injection may at once be proceeded with. Otherwise, it must be delayed ; we are first to turn our attention to cure of the chronic enlargement ; and, after that has been accomplished, the radical operation may then be undertaken. When the testicle is diseased, the accumulation of serum is but a symptom of this affection, and is to be treated accordingly. The palpable cause of the redundant secretion must be removed ; otherwise, reproduction can scarcely fail to occur. For the radical cure, by injection, is not usually effected by glueing the serous surfaces together and obliterating the cavity of the tunica vaginalis, as was at one time supposed. The inflammatory process seldom advances to plastic change ; and the cure is simply by restoring normal function in the membrane. This rule, however, of abstaining from the employment of the radical cure may be departed from in some cases ; in them the injection proving a salutary stimulus for the enlarged gland, as well as for the distended serous sac.

The painful operations by seton, caustic, and incision are now fallen into complete desuetude. Of late, it has been proposed to operate by acupuncture ; making small openings with a needle, through which the serum may gradually escape, partly externally, but chiefly into the areolar tissue—thence to be absorbed. The mode is tedious and uncertain ; but being safe, and little painful, it may be had recourse to when the

March 1832. His first publication on the subject was in the Transactions of the Medical and Physical Society of Calcutta, 1834. *Vide* also Paper read before London Med. Chir. Society, Nov. 1841, published in the Lancet, Nov. 20, 1841 ; and Paper Lancet, in April 30, 1842.

patient decidedly objects to the ordinary treatment by injection ; yet, even then, palliative tapping by a small trocar is to be preferred. More recently wire setons have been employed ; but this method has none of the simplicity and certainty which the method by injection has been so thoroughly proved by ample experience to possess, and should therefore never be put in competition with it.

Children are liable to hydrocele. And in them treatment is very simple. We may succeed in dispelling the fluid, by discutient lotions—such as a solution of the muriate of ammonia ; or by the external application of iodine, used cautiously. Failing in this, the serum is to be evacuated by the simple puncture of a lancet. And this, in the great majority of cases, is sufficient to effect a radical cure. The part swells, reddens, and is painful as after injection in the adult ; and, on resolution being completed, the parts are found in a normal state.

By the term *Congenital Hydrocele*, is usually understood a condition of parts such as leads to congenital hernia ; the vaginal process of peritoneum not having become obliterated. The fluid consequently communicates with the cavity of the peritoneum, usually by a small aperture ; and may be made to disappear gradually from the scrotum, by pressure upwards. In treatment, the first object is to shut up the vaginal process ; and this may in general be effected, by the constant pressure of a truss. In the child, this may suffice for the whole cure ; absorption of the fluid being afterwards hastened by discutient applications. In the adult, the ordinary treatment may be necessary ; but never is injection to be had recourse to, until we are satisfied that all communication with the peritoneum has been completely obliterated. To obtain this result, use of the truss is also important in another point of view. The testicle is liable to injury ; by slight injuries the inflammatory process may, at any time, be lighted up in the tunica vaginalis ; and, from thence, extension to the abdominal peritoneum will be easy and direct, unless the communication have been closed.

By *Encysted Hydrocele* is understood, an accumulation of serous fluid within a cyst, or cysts, independent of the cavity of the tunica vaginalis. Such adventitious formations are usually found connected with that portion of the tunica vaginalis which covers the epididymis ; but they may arise in connection with any part, either of that membrane or of the tunica albuginea. The growth is more irregular than in common hydrocele, and the tumour seldom attains to a large size ; the testicle is situated sometimes in front, sometimes on the lateral aspect ; sometimes at the bottom ; seldom on the back part, as in the common form ; and the fluid is generally paler and less albuminous, than that which is found in the tunica vaginalis. When the bulk is such as to occasion inconvenience, tapping is had recourse to ; and, if nothing contra-indicate, injection may be practised. Should this fail—as is not unlikely, in the case of a plurality of cysts—the wire seton may be introduced, and retained until consolidation has occurred.

The tunica vaginalis has been found the site of much calcareous change, and filled with turbid fluid containing cholesterine. In such a case, cure can result from nothing short of free incision ; and, after all, castration is, in most instances, preferable.

Spermatozoa are sometimes observed in fluid withdrawn from hydrocele ; and such fluid is usually of a milky appearance. It seems uncertain whether these have escaped from an accidental wound or giving way of the tubular structure, either of the testicle or of the epididymis ; or whether the cyst, from which they are derived, has been formed by dilatation of a part of the tubular structure—as takes place in lacteal tumour of the breast, and in ranula. Whatever their origin, their presence is not found to contra-indicate the ordinary cure by injection.

Hydrocele and hernia may co-exist ; and, as the former enlarges, the cord and abdominal aperture may come to be so occupied and compressed as to prevent hernial descent. A hydrocele, thus enacting the part of a truss, need not be interfered with, unless productive of much inconvenience by its weight and bulk.

II. *Hydrocele of the Cord*.—This may be either diffuse or encysted. The *Diffuse* form is comparatively rare. A serous fluid accumulates in the areolar tissue of the cord, and is enclosed in a distinct sheath ; this again is covered by the cremasteric expansion. The swelling is seldom of large size ; uniform, and somewhat pyramidal ; of slow formation ; and not attended with any considerable uneasiness. The base rests on the point where the spermatic vessels join the testicle, and is separated from the tunica vaginalis by a dense septum ; hence, the testicle is felt, distinct, in its ordinary site. If the abdominal aperture be not encroached upon, there can be no difficulty in diagnosis ; but, when the swelling extends within this, it is apt to be mistaken for omental hernia. The chief points of difference are, the completeness in reduction of the hernia, the clearness of the cord after reduction, and the impulse given upon coughing ; in the hydrocele, also, fluctuation is in general tolerably distinct. The fluid has been found reducible within the abdomen, but not into the abdominal cavity ; passing up along the spermatic cord—probably in its areolar tissue—and, when past the abdominal ring, forming a distinct tumour in the abdominal parietes. In some cases a large cyst exists within the abdominal cavity, from which an offshoot, in the form of a finger-like process, extends down the inguinal canal, and may protrude at the external abdominal ring when the patient stands erect or coughs. Thus closely simulating a hernia, its true character may easily enough be mistaken by one not conversant with the peculiar sensation on handling which this form of hydrocele presents.

Unless the swelling prove large and inconvenient, it need not be interfered with. The best mode of cure, probably, is acupuncture, aided by local discutients. The punctures are made at the lower part of the tumour, and need not be numerous ; for the fluid readily escapes from space to space ; and, not unfrequently, these are broken down into larger compartments.

Encysted hydrocele of the cord is the more common variety. The serous fluid is contained within a distinct cyst ; sometimes of adventitious formation ; sometimes formed of an unobliterated portion of the vaginal process of peritoneum. Growth is slow and painless. The tumour is circumscribed, oval, tense, and fluctuating ; often plainly translucent ; always movable on the cord. The testis is felt distinctly separate. And no difficulty in diagnosis exists, unless, as sometimes happens, the swell-

ing extend within the abdominal parietes. In general, however, the tumour can be pulled down from the abdominal aperture, permitting the cord to be felt free above ; and, besides, the tumour can never be wholly reduced within the abdomen—a certain degree of tense fulness always remaining in the upper part of the canal. In the child, this affection will disappear under discutients. In the adult, it seldom demands interference. If it should, it may be got rid of by tapping and injection.

III. *Hernial Hydrocele*.—When a scrotal hernia has been reduced, and the neck happily becomes obliterated, the sac, remaining, may be filled by serous accumulation. A pyramidal, fluctuating, and translucent tumour will result ; of easy diagnosis ; and amenable to the same treatment as an ordinary hydrocele. The affection is of rare occurrence. It may form in cases where, with undue force, a hernia has been forced back, and the bowel has given way within the abdominal cavity. The easy reduction of the fluid, the probable distension of the sac with fluid mingled with gas, and the sunken condition of the patient, will indicate that though little good is likely to follow any operative interference, still the evacuation, even from the peritoneum, of such putrescent material, affords the only chance of saving the patient.

IV. *Hydrocele in the Female*.—The term Hydrocele is applied to an œdematous state of the round ligament ; analogous to diffuse hydrocele of the cord in the male. Also, a prolongation of peritoneum along the round ligament of the uterus may remain in communication with the abdominal cavity, by means of a narrow aperture at its neck ; and this pouch may become the seat of serous accumulation, constituting a tumour analogous to congenital hydrocele of the male. Besides, the round ligament is liable to be the seat of cystic formation ; analogous to encysted hydrocele of the cord in the male. The affections are rare ; and seldom require active treatment.

Hæmatocele.

This may be the consequence of external injury ; or it may be of spontaneous occurrence. By the term is understood an accumulation of blood, in one of three localities : the areolar tissue of the scrotum, the areolar tissue of the cord, and the tunica vaginalis.

1. *Ecchymosis or Superficial Hæmatocele of the Scrotum* is the result of bruise, or oblique wound ; and is analogous to an ordinary bruise, both in nature and in treatment. The scrotum swells, and is discoloured ; the hue is blackish, like that of urinous infiltration ; but the diagnosis is easy, by attention to the history of the case—also noting that there are none of the signs of gangrene present, and that the system is comparatively unaffected. The treatment consists in arresting the inflammatory process, and afterwards favouring absorption of the extravasated blood by local sorbefacients. Incision is withheld, unless suppuration have unfortunately occurred. Support of the parts and repose in the recumbent position is usually necessary.

2. *Hæmatocele of the Cord*.—A spermatic vein may give way, under external injury, or great bodily exertion ; and extravasation into the areolar tissue will result, forming a tense, discoloured tumour there. The treatment is as for the preceding variety.

3. *Hæmatocele of the Tunica Vaginalis* is the most common form ; and to it, in strict accuracy, the term should be limited. The blood is extravasated into the cavity of the tunic ; and may be associated, or not, with hydrocele. By wound of the testicle, in tapping—or by a blow or other external injury, or by the spontaneous giving way of a blood-vessel—a hydrocele may at any time be converted into hæmatocele. The tumour suddenly increases in size, and is the seat of pain ; and, when handled, is found heavier, and less fluctuating than before. The blood, if in small quantity, becomes diffused in the serous fluid ; when copious, a portion coagulates, and assumes the fibrinous arrangement. This acting as a foreign substance, may excite the inflammatory process ; and suppuration may take place, with much increase of swelling and pain. Very frequently the affection is associated with chronic enlargement of the testicle—Hæmatosarcocele.

When hæmatocele is unconnected with hydrocele, the treatment is as for other simple extravasations—antiphlogistic and sorbefacient ; the formation of matter being the only indication which requires use of the knife. When the extravasation supervenes on hydrocele, simple tapping is in the first instance to be had recourse to ; and should the fluid be thin, containing but little blood, and none coagulated, there is no reason why injection should not be resorted to. In the confirmed cases—and more especially when suppuration is already threatened—the only mode of obtaining a radical cure is by free incision ; laying the cavity fully open, turning out the coagula, and obtaining closure of the gap by granulation ; care being taken to avoid wound of the testicle. If the tunica vaginalis be found thickened, and otherwise much altered, the greater portion may be cut away ; as thus the amount of suppuration, and the period of cure, will be materially abridged. In fact, in many cases, from its close resemblance to a solid tumour, the hæmatocele has been excised, and with it of course the testicle. Indeed, the degree of atrophy produced by the long-continued pressure, and the risk of suppuration from so large and unhealthy a surface, have in many instances led to excision being practised in those cases where the hæmatocele had been diagnosed.

Cirsocele.

A varicose condition of the veins of the spermatic cord is termed Cirsocele, or Varicocele. The pendent nature of the part predisposes to this affection. And the ordinary causes are such as favour varix in general ; especially constipation, and laborious exertion in the erect posture ; as also tumours, trusses, and whatever causes obstruction to upward flow in the cord. The left side is much more frequently affected than the right ; the left testicle usually hanging lower than the right ; and the left spermatic vein being not only longer in its course, but also more exposed to compression by faecal accumulation in the sigmoid flexure of the colon. The swelling is usually pyriform ; with its base on the testicle, its apex upwards ; and, on manipulation, the veins can be distinctly felt rolling under the fingers, like cords or earth-worms. When the patient lies down, all swelling may disappear ; but so soon as he rises, the tumour becomes large and tense, eluding firm pressure over the

external ring. There is a sensation of weight and uneasiness in the part; the testicle may be the seat of neuralgia, sometimes it becomes atrophied. An aching sensation in the groin and loins is not unfrequent. Sometimes the swelling proves very inconvenient, from its mere pendulousness and bulk; as in saddlers and others, who require close approximation of the thighs in their vocational labour—and in those who are much on horseback. Occasionally, a mental despondency is observed, greater than the bodily ailment would seem to warrant.

Treatment is palliative or radical. The former consists in avoiding or removing the more obvious causes of the affection, keeping the testicle well supported by a bandage, and bathing the parts frequently in cold water. When the integuments of the scrotum are very redundant, the testicle may be retained in close contact with the groin, by invagination of the loose integument through a padded soft metal ring. Or such trussing may be more effectually maintained, by removing the redundant skin by incision; support of the testicle being then intrusted to the cicatrix.

When the testicle is suffering either by neuralgia or by atrophy, or when much uneasiness and discomfort are experienced, eradication of the disease is naturally sought for. With this view, the varix may be treated here as elsewhere—by obliteration of the veins. 1. The actual cautery may be used; a heated awl being applied to the veins, isolated and fixed between the finger and thumb. The practice is safe and effectual, but the formidable nature of the application is a serious objection. 2. The veins may be compressed by suture, applied on needles passed beneath them by transfixion; as in ordinary varix; care being taken to exclude the vas deferens and the spermatic artery. Obstruction of the duct is tantamount to castration, and obliteration of the artery may be followed by atrophy of the testicle. 3. The operation of M. Vidal may be performed. The varicose veins, having been separated from the rest of the cord, are placed between two silver wires, passed by the transfixion of needles, and emerging at the same openings. By twisting together the ends of the wires, the interposed veins are compressed; and, by a continuance of the twisting, they are rolled up round the wires, while at the same time the testicle is proportionately elevated. The ends are then secured across a roll of bandage placed on the integument. The operation may also be performed by means of Mr. Wood's rectangular needles. The wire or needles may be removed at the end of a fortnight or three weeks. Or, by further twisting of the united ends, by means of dressing forceps, the compression and twisting of the veins are gradually increased; and this is continued, until the wires free themselves by ulceration—thus declaring section and obliteration of the veins to be complete. 4. Obliterative pressure may be maintained on the veins at the groin, by means of a spring truss. But this, for obvious reasons, is not advisable. Moderate pressure there, however, is found very serviceable; not merely palliating, but sometimes obtaining cure; probably by affording support to the veins, while they are at the same time relieved from the superincumbent weight of blood. Such moderate pressure is best applied by a light and accurately fitted truss.* It

* CURLING on the Testicle; and THOMSON, Monthly Journal, Nov. 1848, p. 295.
 "Evans' moc-main lever truss" is very suitable.

is also advisable that the patient's trousers should be made tightly fitting to the fork. By dressing to the same side, he thus secures both support for the testis, and sufficient compression of the spermatic veins ; and can dispense with the use of a truss altogether, after a time. One great advantage of such treatment is its simplicity, and freedom from risk by phlebitis.

A variety of varicocele occasionally occurs, affecting the veins within the inguinal canal, and at the groin ; while those of the scrotum are comparatively free. It is very liable to be mistaken for hernia, as formerly noticed. The best test is the peculiar sensation imparted to the finger and thumb when the part is pinched and rubbed. Palliative treatment usually suffices. But should a radical cure be sought, the preferable means is the application of pressure by a truss.

Tumours of the Cord.

Occasionally, adipose tumours form in the areolar tissue of the spermatic cord. Their bulk is inconvenient, and their pressure may cause atrophy of the testicle. They are to be removed by incision. Fibrous tumours and osseous formations have also been found here ; but are rare. The testicle, arrested at the groin, in its descent, may become affected by tumour ; and in that situation may require removal by operation.*

Castration.

This mutilation is seldom required, except for tumours of the testicle ; malignant, or such as, though simple, are not amenable to either discussion or disintegration. In neuralgia of the testis, and in cirsocele, it is sometimes demanded by the patient ; but in neither case is the surgeon warranted in acceding to the wish.†

All hair having been removed from the scrotum and groin, the patient is placed recumbent. By grasping the tumour behind, the skin is made tense. The bistoury is entered at the neck of the swelling, and carried to its fundus ; diverging over the body of the tumour, so as to include a sufficiency of skin within an elliptical incision. This form of wound is especially necessary, when a fungus, ulcer, or other involvement of the skin, requires to be taken away. A simple rectilinear wound would suffice for removal of the tumour ; but a redundancy of skin would be left, constituting a pouch for accumulation of blood or pus. On the other hand, it is very necessary to avoid excessive removal of the integument, lest, on contraction, a bare sufficiency be found for effectually covering the remaining organ. And, in connection with this, it is important to remember that the covering of a large sarcocele is borrowed from the adjoining parts ; and that, consequently, after incision, a great degree of resilience in the integument is certain to occur. The dissection is advanced, first at the upper part of the wound, so as to expose the cord ; this having been isolated, the cremasteric covering is

* Lancet, No. 1214, p. 617.

† Castration may seem expedient in Hermaphrodisism.—Monthly Jour., Dec. 1852, p. 573.

circularly incised, so as to prevent all risk of retraction of the vessels of the cord when this is cut across. The assistant then seizes it, not to prevent retraction but to arrest bleeding ; and the cord, so held, is divided ; the apex of the tumour is then everted, and dissection rapidly proceeded with—thus rendered comparatively painless and bloodless. Care is taken not to wound the septum, and thus to expose the sound testicle. The arteries of the cord are secured by ligature. And, should they have slipped from the fingers of the assistant, a very slight upward enlargement of the superficial wound is all that can ever be required. The scrotal vessels are tied with especial care ; experience warning us that, otherwise, troublesome after-bleeding is almost certain to occur. The wound is brought together, and treated in the ordinary way. The lower part seldom heals but by granulation ; and, therefore, need not be closely approximated. The cord requires to be carefully watched ; diffuse suppuration being apt to occur there ; and should this threaten, early incision must be had recourse to.* But, by suitable antiphlogistic precautions, all necessity for resumed use of the knife may generally be avoided.

It is important to remember that, like hydrocele, sarcocele may co-exist with hernia ; and that the latter may be temporarily restrained by the bulk of the tumour of the testicle. On removal of this, however, the hernia, descending during the cries or straining of the patient, may appear at the wound.

Impotence.

This may depend on imperfect development of the testis ; but not on imperfect descent. The organs are as efficient, functionally, in the abdomen as in the scrotum. Ablation and atrophy of both organs cause impotence ; but either testicle may be lost with comparative impunity. The oxalic diathesis, and diabetes, diminish the sexual appetite and power ; and so does the phosphatic diathesis, to a less degree. The pressure of hydrocele may cause impotence, even without atrophy of the testicle. Temporary impotence may be caused by induration of the epididymis on both sides, resulting from gonorrhœal epididymitis. When a scrofulous testis exists upon each side, a more permanent impotence—also due to obstruction of the vas deferens—usually takes place. Affections of the brain are sometimes followed by it. In the newly married, a temporary loss of power is sometimes caused by mere predominance of mental emotion. But excessive venery, inducing an irritable state of the whole genital system, is perhaps the most frequent cause. And effete *roués* thus “read their sin in their punishment.”

Cure can be expected only in those cases which are unconnected with structural change in the testicles. The cause having been removed, certain medicines are supposed to have a tendency to restore this animal function, and are hence termed Aphrodisiacs. Of these, the most important are, Indian hemp, conium, and phosphorus ; the two former

* To avoid the risk of such inflammatory results being excited by unnecessary pressure of the assistant who grasps the cord, it is often well to tie the artery at the moment of the cord's division ; so superseding the necessity of pressure there altogether.

most suitable in cases of irritability ; the latter given, in very guarded doses, for the more chronic examples. Musk, cantharides, steel, cold salt-water bathing, and other tonics, may also be of service ; and diet should be generous. The marital and mental cases may be left to work their own cure.

Spermatorrhœa.

An irritable state of the spinal cord, testicles, seminal vesicles, bladder and urethra, with a turgid and especially irritable condition of the prostatic portion of the urethra, leads to frequent and involuntary emission of the seminal fluid. In speaking of this as a diseased condition, it should be borne in mind that the occasional occurrence of emissions of seminal fluid in robust, healthy adolescents, and adults—especially between the commencement of puberty and thirty years of age—who lead perfectly chaste and regular lives, cannot be considered as a state of disease, or checked by treatment unless of a kind calculated to enfeeble and exhaust the system. In some cases, the emissions only occur when from any cause the bodily health suffers from intense mental application, and when at the same time the appetite for food is greater than what is normal. By much the most frequent cause of the commencement of this morbid state is masturbation ; and, next in order, comes excess in venereal indulgence :—not when these depraved practices are indulged ; but usually as soon as the patient, for any reason, after a long continuance, gives them up. Stricture, prostatic diseases, and irritation communicated from diseased rectum, are common causes of minor forms of the affection. In consequence of the irritability, an impression much inferior to the normal stimulus suffices for production of seminal discharge. Slight venereal excitement, by day or night, causes emission ; and the contents of the prostatic crypts and seminal vesicles are also discharged during straining at stool, and by the effort of evacuating the last drops of urine in micturition. It is a curious fact in the etiology of this affection, that the patient experiences none of the dejection, depression of mind, and sense of excessive languor and nervous exhaustion, with giddiness, *muscæ volitantes*, pain in the head and loins, which are usually complained of by him, when he seeks professional counsel, till he has read some of the disreputable quack books which pretend to treat of this disease, and which are so diligently circulated by designing scoundrels among lads attending public schools and educational institutes. It is but a fair inference, therefore, that in many cases at least, these symptoms are only the result of an excited imagination. This, directed with an unusual acuteness of perception to every ache and pain, every change of colour, every alteration in the condition of the urine, and even to the frequency with which it is passed, will discover states of system which tally with the highly-coloured and exaggerated pictures delineated in those secret monitors, which they fear to read, yet cannot refrain from. In such cases, accordingly, the unfortunates ultimately become the victims of a perverted imagination ; and, like mesmerised creatures, will follow with avidity every suggestion of the wretches who have gained their ear. The object of such authors is simply to put money into their own pockets ; and so long as the foolish youth can be plucked by them, they keep him

in their hands ; throwing him overboard to despair when his pockets are emptied, and every resource of the art of terrorism has ceased to produce a golden result. In proof that such is really the case, many instances are observed where re-assurance of the patient, with exposure of the fraud, has often served without any treatment to cure both the emissions and the protean diseases they are supposed to produce. In other cases, however, some diseased condition of the gastro-hepatic system is apparently the source of the whole mischief ; a decided bilious or oxaluric diathesis existing. In other instances, mere distension of the bladder during sleep occasions the evil ; and in others, again, a hyperæsthetic condition of the spinal cord, analogous to what, at a higher point of the cerebro-spinal system, would induce epilepsy, is undoubtedly the determining cause of the association of conditions which produce the combined action resulting in emission. In some of these cases, a phosphatic state of the urine is present. Other morbid states, more nearly situated, often serve to induce the frequent repetition of this discharge ; such as hemorrhoids, fissure of the anus, or ascarides in the rectum.

The principles of treatment are obvious. Chastity in thought, word, and deed ; cold bathing, and a tonic system of treatment ; regulation of the bowels, but avoidance of purgatives, or other sources of local irritation and general exhaustion ; a hard bed, sleeping in any position but on the back ; early rising, cheerful society, and healthful occupation of body and mind. The patient's food should be simple, nutritious, and non-stimulating. Even coffee and tea should be avoided ; and no meal should be taken late in the evening—or any fluid, for four hours at least before going to bed. In some cases nitric acid and quassia, or phosphoric acid with strychnine, do good ; in others, alkalies, with belladonna or atropine, allay the irritation ; in others, ergot of rye, and counter-irritation over the lumbar region, or over the perineum and buttocks, will be found eminently satisfactory. Some laud very highly bromide of potassium and oxide of zinc. Tincture of the muriate of iron is useful only in the anæmic. In mild cases, the occasional introduction of a common metallic bougie may succeed in removing the irritability ; rendering recourse to the more painful and hazardous cauterization unnecessary ; and cold enemata may be of service. Compression of the urethra, by a pad applied to the perineum, has also been found useful.* If the irritability continue obstinate, nitrate of silver may be applied to the posterior part of the urethra, by means of the *porte-caustique* of Lallemand. This instrument consists of a straight or curved platina canula or tube, rather smaller than a middle-sized catheter, through which plays a caustic-holder ; and in the further extremity of this there is a narrow groove, eleven lines in length, for the purpose of holding the caustic. After filling the groove with the nitrate of silver, by fusing it over a spirit lamp, it becomes so securely fixed, that there is no danger of it escaping. At the other end there is a sliding screw or stop, by which the action of the remedy may be limited to any extent less than the groove which contains it.

* Ranking's Retrospect, vol. ii. p. 118. See also, on this subject, Lallemand, *des pertes seminales involontaires*, Paris, 1842. *Brit. and Foreign Review*, April 1843, p. 346. Phillips, *Med. Gazette*, Jan. 1843. Civiale, *Memoire sur l'Emploi des Caustiques dans quelques Maladies de l'Uretre*, Paris, 1842.

Another sliding stop affixed to the canula serves, after the distance of the orifice from the part to be cauterized has been ascertained, to prevent the instrument passing further into the canal. Having arrived at the tender part—which is at once indicated by the feelings of the patient—the stilet is projected, so as to expose the caustic ; and, by gently turning the instrument, an efficiency of application is insured. Afterwards, strict rest, with antiphlogistic regimen, should be maintained for a day or two ; and, if need be, sedatives are given, either by the mouth or by the rectum. Repetition may be required, after a considerable interval.

This obscure and distasteful class of cases is still much in the hands of unprincipled practitioners and quacks. This is no reason, however, for leaving the unfortunate victims in such a predicament, or for denying the existence of such affections. Acknowledging the malady rather as a symptom than as a disease, it seems plainly the duty of our science and art to afford what assistance may be in our power ; at the same time remembering, that without strict purity of conduct on the part of the patient, all treatment will prove of little avail.

It is also most important to remember, that all the alleged cases of this affection, occurring in the form of “diurnal” spontaneous emissions, are mere simulations ; urethral or prostatic gleets ; or conjurings of the patient’s own fancy—the result of the state of hypochondriasis produced by the suggestion and imposition of cunning and unprincipled knaves.

CHAPTER LXIII.

AFFECTIONS OF THE SCROTUM AND PENIS.

Erysipelas of the Scrotum.—Acute Œdema of the Scrotum.

ERYSIPELAS not unfrequently attacks the scrotum, in a distinct and marked form ; peculiarly destructive in its type ; partaking much of the characters of diffuse areolar infiltration. It occurs in adults of weak and broken down system, given to drink and other dissipation ; and usually follows a kick, blow, or other injury. Swelling is great and rapid ; with marked symptoms of constitutional irritation from the commencement. Thin, unwholesome matter speedily forms, and is diffused into the areolar tissue. The skin — at first red, tense, and glistening — blackens, or assumes a tawny hue, shrivels, and becomes cold and fœtid. Sloughing is begun and advancing. Very frequently, the groins are involved ; and the mischief extends upwards in the abdominal parietes. The constitutional symptoms soon pass from the irritative into the typhoid type ; and fatal sinking follows. Local and general safety can be obtained, only by early and active interference. Often the chalybeate treatment is found specially successful. During the whole progress of the affection, the scrotum should be constantly kept well supported.

Erythema may occur at any time in the scrotum, under the ordinary exciting causes. It follows the ordinary course, and requires the ordinary treatment.

The areolar tissue of the scrotum is very liable to simple serous œdema ; occurring sometimes as a distinct affection ; much more frequently a concomitant of general anasarca. When excessive, relief and diminution may be obtained from a few dependent punctures ; made cautiously, however, lest inflammatory accession ensue.

Elephantiasis of the Scrotum.

The scrotum is liable to chronic enlargement by hypertrophy ; forming a large simple tumour, within which the genital organs come to be altogether concealed ; the prepuce alone remaining visible, at the lower part of the swelling, thickened, and warty ; and from this point the urine is discharged in a scattered stream. The affection is much more frequent in hot climates than in this country. There is no cure, but by use of the knife. When the tumour is of no vast size, the incisions may be planned so as to save the penis and testicles ; and dissection is conducted cautiously with this view.* In the case of a large tumour, however,

* Further details of this affection, and of the operative treatment required, with diagrams, will be found given by Dr. Brett, *Lancet*, No. 1174, p. 241.

such an attempt may be hazardous ; the patient being apt to incur fatal exhaustion, under the tedious and painful operation, and the copious loss of blood. It is then better, probably, to sacrifice everything ; and to effect removal, at once, by a few rapid strokes of an amputating knife. Before proceeding to any operation, however—and more especially to summary ablation—it is most necessary to ascertain whether or not scrotal hernia exist. If such be found, the incisions must be planned



Fig. 345.

and conducted with peculiar care. Dr. Fayrer of Calcutta has recommended that to prevent hemorrhage during the progress of the operation, a stout cord should be carried round the neck of the mass, and both ends having been passed through a steel ring of the size of a common curtain ring, constriction is effected by assistants drawing steadily upon both ends of the cord. A strap and buckle has been also used for the same purpose.

Chimney-Sweeper's Cancer.

The integuments of the scrotum are liable to malignant ulceration ; more frequently found in London chimney-sweepers than in others—probably on account of the irritation of soot, and habits of uncleanness ; but the disease is not limited to that peculiar vocation. It is a remarkable fact certainly, that the only case of chimney-sweepers' cancer which has occurred in Edinburgh for many years, was that of a man who had previously worked for a long time in London. The ulcer begins in the

Fig. 345. Hypertrophy, or elephantiasis of the scrotum, in a Hindoo.

form of a wart ; and frequently is surrounded by warty formations. It may spread rapidly. The affection is of the nature of epithelioma. Cure is by excision, or by thorough destruction by means of chloride of zinc paste ; and certainty of success is to be hoped for only at an early stage—when the disease is as yet limited to the integument, and when no great amount of even this tissue is involved. At a more advanced period, when the testicle is exposed, and probably contaminated, a chance may yet be afforded by castration ; provided the groins are free from secondary enlargement, and the constitution is not much broken down.



Fig. 346.

Priapism.

Permanent erection of the penis occurs in three forms. 1. From injury of the spine. This has been already noticed, as a distressing symptom of spinal fracture. 2. From vascular and nervous excitement, induced by excessive venereal stimulus. The turgescence may be such as temporarily to occlude the urethra, causing retention of urine ; and this is to be treated by antiphlogistics and antispasmodics, as formerly noticed. 3. A more formidable variety may occur from the same cause as the preceding ; dependent on extravasation of blood into the corpora cavernosa—a vessel of some size having given way. In a case of urgency, it may be necessary to evacuate the extravasated blood by incision ; but, in general, it is better to treat the case according to the general principles applicable to bruise ; averting inflammatory access, and favouring absorption. If incision be made, there is great risk of troublesome suppuration following ; incapacitating the organ afterwards for normal erection.

Sometimes chronic product, of a plastic kind, and probably of inflammatory origin, takes place in the corpus cavernosum ; producing thickening, perhaps with enlargement of the part, and more or less obliteration of the erectile tissue. Erection, consequently, is imperfect and painful. Treatment will mainly consist of counter-irritation and sorbefacients to the part, with alteratives internally. Should stricture co-exist, that must be removed in the ordinary way.* Camphor and henbane, or belladonna pills, in which many believe, are usually of but little service in the inflammatory and spasmodic forms ; an opiate enema, and antimonials, or an emetic, proving vastly more efficacious.

Phymosis.

Phymosis and Paraphymosis both depend on preternatural contrac-

* H. J. JOHNSON, *Lancet*, No. 1473, p. 481.

Fig. 346. An aggravated example of chimney-sweepers' cancer ; much superficial texture destroyed.

tion of the preputial orifice ; the difference being, that in the one case the contracted portion occupies its normal position in front of the glans ; in the other it is reflected behind the glans, and acts as a constriction there on the body of the penis.

Phymosis may be congenital ; an original malformation. In this case, if the contraction be great, the child is apt to suffer much. The urine escapes imperfectly ; and, in consequence, chronic balanitis may ensue, or a calculous concretion may form, or the bladder may become irritable, and symptoms closely resembling those of stricture of the urethra may develop themselves. Should these dangers pass by, and an advanced age be reached by the patient, ulceration is apt to take place at the contracted part ; and, very frequently, the ulcer assumes ultimately a malignant

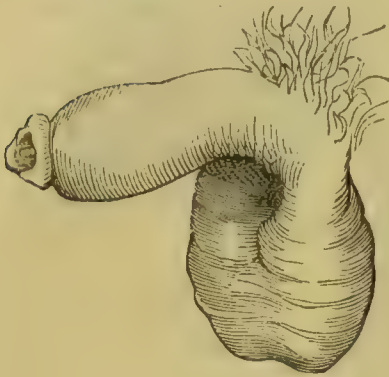


Fig. 347.

action, and extends so as to involve the glans and body of the penis. It is important, therefore—on many accounts—to remove this source of evil as early as possible.

Acquired phymosis may be acute or chronic. The former is the result of an active inflammatory process ; following external injury ; or sympathetic with gonorrhœa, balanitis, or sores situated within the prepuce. The areolar tissue becomes infiltrated with serum ; the swelling, thus caused, prevents the glans from being uncovered in the usual way ; and discharge, accumulating, aggravates the disorder. The main treatment is by rest, fomentation, poultice, and general antiphlogistics ; and, at the same time, by means of injections frequently repeated, accumulation and decomposition of the discharge are to be prevented. Under this management, swelling may more or less rapidly disappear, and the normal state be regained. Failing this, and if there be urgency for the exposure of sores—which may be extending rapidly, and may require activity in direct applications—incision is necessary. It may be that the urgency is such as to demand the knife very early in the case, while the sores are yet fully impregnated with virus ; and then there is risk of the disease being much extended, by contamination of the recently made wound. Such risk may be in a great measure obviated, however, by applying first the saturated solution of the perchloride of iron to check the bleeding, and then an active escharotic immediately afterwards to the sore, so as to annihilate both the local poison and the poisoned part. In general, the operation is to be delayed, until the sores are of such a date as to render impregnation of the wound at least improbable—the reparative stage having been reached, when discharge probably ceases to be virulent. If any doubt should exist as to the presence of a chancre of the soft kind, occupying some part of the interior of the prepuce, inoculation by the lancet, of a single drop of the pus on any part of the surface, will remove all uncertainty.

The chronic form of acquired phymosis may result from gradual increase of original malformation, or from cicatrization of ulcer or wound.

Fig. 347. Phymosis.

Like the congenital form, it is to be relieved only by operation. And this may be performed in various ways.

1. A simple and very suitable mode consists of inserting a director into the preputial cavity between the prepuce and dorsum of the glans penis; retaining it either where introduced, or by the side of the frænum, a sharp-pointed curved bistoury is carried along the groove; and, transfixing the foreskin, all is divided from behind forwards. Before using the knife, especially when the parts are much tumified by inflammatory change, the surgeon should make sure that the director's point is in the preputial cavity, and not in the urethra. The dorsal site of the incision is chosen in acute cases, when we believe that ulceration exists within, in order that the tension of the parts and pressure of the prepuce upon the surface of the sore may be as thoroughly relaxed as possible, while plenty of room is afforded for the escape of discharge and the application of dressings. In cases where the prepuce is dark from venous engorgement, enormously swollen, and threatening to slough, the wings left on either side by the dorsal incision should be removed by curved scissors, applied along the line of the balano-preputial furrow. When the preputial tissues are in a perfectly normal condition, except at the orifice, simple section of the parts is by many recommended to be made by the side of the frænum—as here a less amount of wound suffices; the glans is equally well exposed; and, after cicatrization, no unseemliness results, nor is there any departure from the normal relative position of the parts. This, however, may be but a doubtful advantage; as in many cases the apparently unseemly flaps, left by the dorsal section, afterwards retract, and leave only a slight redundant fold of integument on either side behind the glans penis; while the large, loose, bag-like, irregularly-formed fold of texture, sometimes left after the lateral section, may be not only unseemly at the time, but may become more and more so—besides affording an inviting surface for the invasion of chancres at any future period. To prevent resilience of the integument from the mucous membrane, and thereby avoid an unnecessary extent of raw surface, a point of suture on each side is required; and this is retained, until spontaneously freed by ulceration, or until consolidation has taken place—whereby the natural resilience is obviated. When, however, sores are found to exist within the divided prepuce, the cut surface should be destroyed by means of the saturated solution of perchloride of iron; and thereafter the chancreous surface is to be got rid of by means either of the iron likewise, or—better—by caustic potash, or nitric acid.

2. When the prepuce is redundant in front of the glans, the following operation is suitable:—An oblique line corresponding to the anterior third of the glans penis is marked upon the prepuce, the extremity of which is then drawn forwards until the mark clears the point of the glans. A pair of dressing forceps are then made to compress the foreskin immediately behind the black line, so as to keep the glans out of harm's way, and at the same time to assist in steady-ing the cutaneous textures as they are divided by a stroke of the bistoury. In this way, a mere ring of the cutaneous and areolar tissues of the prepuce is removed by the operator. Circumcision, in fact, is performed; but only to a limited extent. The skin is found free enough, but the mucous membrane still tightly covers the glans; this is now slit up,

by scissors, upon the dorsum ; or a V-shaped portion may be cut out, to make the line of mucous membrane correspond more nearly to that by which the skin has been divided. The flaps of mucous membrane are then secured, by a fine suture, to the corresponding portion of the integument. This mode of procedure is best suited to those cases which are congenital, or where the contraction is due to the cicatrization of a cluster of venereal sores on the very verge of the prepuce. It is also advisable when, in any case, the end of a long prepuce is still occupied by an ulcerated surface. In such circumstances, however, preliminary injection of the interior of the foreskin should be employed by the surgeon, lest any of the matter lodging within should contaminate the cut surface. In order to effect the division of both skin and mucous membrane by the same incision, various ingenious contrivances have been devised. The simplest consists in introducing a harelip pin—the point sheathed with a bit of wax—between the prepuce and glans, and causing it to protrude through the skin on the dorsum at the ink line. Vidal de Cassis recommends that the skin and mucous membrane at the orifice should be secured, drawn equally forwards, and held steady during section by means of two pairs of artery forceps. The forceps employed for compressing the prepuce, and guiding the line of incision, are sometimes made specially for the purpose, with fine projecting needle-points on one blade, which pass through the tissues of the foreskin, and are received into apertures in the other blade. While, by others, the blades are made fenestrated, so that the sutures may be passed before the preputial textures are divided. These last-mentioned contrivances, though certainly accelerating the operative manipulation, and giving a mechanical precision to the procedure, are objectionable as requiring special instruments, when those ordinarily carried in the pocket-case amply suffice for accomplishing the object in view.

3. In cases of congenital phymosis in young children, instead of performing a partial or complete circumcision, or slitting up the whole thickness of the foreskin, section of the mucous membrane of the interior, and division of the cutaneous tissue at the mere opening of the prepuce, will suffice to permit retraction. This division may be effected by either knife or scissors. In employing the former, a director is first introduced ; upon it a tenotomy knife is carried as far back as the corona glandis ; and the mucous membrane is divided from behind forwards as the knife is withdrawn. When the scissors are used, the foreskin is forcibly retracted, so as to expose the opening in the preputial mucous membrane ; the blunt point of the scissors having been introduced into this, the tight aperture is divided, further retraction is made, and section of the entire mucous membrane is effected bit by bit, from before backwards, until the glans is left completely denuded. Should adhesions exist between the glans and prepuce, these should be broken down with the finger nail ; and the sebaceous secretion which is usually found lodging in the furrow should be cleaned away. The exposed mucous surfaces should then be well oiled, and the foreskin drawn forwards. During cicatrization, the prepuce must be daily retracted, else cicatricial contraction may reproduce the deformity.

4. In some cases, in children as well as in adults, lateral incision of

both the mucous membrane and skin of the orifice of the prepuce, on each side, to the extent of about a quarter of an inch—thus forming a square-mouthed opening to the pouch—should be preferred. A single stitch, uniting the skin and mucous membrane at the angle of junction in each incision, is all that is afterwards required. In operating for phymosis, in any way, the small arteries which bleed should be carefully secured by torsion—or, if need be, by ligature—else copious hemorrhage may take place externally, or with a more troublesome result into the loose areolar tissue of the foreskin and penis.

Paraphymosis.

A tight preputial orifice, reflected behind the glans, and permitted to remain there, constricts the body of the organ, and gives rise to very unpleasant consequences. The superficial areolar tissue of the penis swells greatly, behind the constriction; while the pouting mucous membrane of the interior of the foreskin, becoming everted, forms a brawny collar behind the glans. Between the two swellings the constriction lies concealed; the glans also becomes tumid; and an acute inflammatory process is kindled, under unfavourable circumstances—the strangulated parts, especially when these happen to be the site of chancres or of simple ulceration, being obviously ill provided with the power of resistance or control. There is the same necessity for relief, as in the case of strangulated hernia, so far as the preservation of structure is concerned; and this is sought in the same way. Reduction is generally practicable, in recent cases. The patient having been laid recumbent, and the parts having been well oiled, the surgeon grasps the glans with the fingers of the right hand, and makes steady pressure thereon, pushing it steadily from him; at the same time, with the fingers of the left hand, he draws forward the constricting orifice; his object being to push the glans, diminished by pressure, through the narrow preputial aperture. In other cases, where the constriction is greater, introducing the nails of the fore, middle, and ring fingers of both hands into the sulcus between the two swellings, the firm collar of the everted mucous membrane is steadily supported, while the thumbs are employed to force and knead the turgid glans under cover of the prepuce. To secure the compression of the glans more thoroughly, a piece of tape, about an inch in breadth and about a foot in length, is employed. An aperture is made lengthwise in the centre of the tape, through which one end is passed; the glans is now encircled with the loop, while the extremities are wound round the little fingers, so that, during flexion of these, the glans shall be laterally compressed and elongated, so as more readily to recede within the constricted orifice of the prepuce (Garcia Thirésa*); or compression of the glans may first be effected by means of a strip of adhesive plaster, about half a yard long and a quarter of an inch wide, applied forcibly around the glans—beginning behind at the furrow, and terminating near the orifice of the urethra (Van Dommelen). Guerin of Brussels invented a pair of spoon-bladed forceps, by which the glans could be seized, compressed, and pushed within the preputial covering.

* Revue de Thér. Med. Chirurg., Feb. 15, 1860.

Professor Colles recommended the insertion of a hernia-director beneath the constriction, to be employed as a lever to tilt the tight orifice on each aspect over the projecting corona glandis. Compression of the whole penis by longitudinal, and then by spiral strips of adhesive plaster, firmly applied, has been recommended and employed with great success by the surgeon of the Children's Hospital at Pesth. Anæsthesia is very necessary in all these proceedings.

Failing these, or before they are employed—especially if there be no marked urgency—another mode of reduction may be attempted. The penis having been placed erect, a bag of ice is put upon it, or a stream of cold water is directed against it for some time. This has the effect, in many instances, of so diminishing the bulk of the formerly turgid part, as to admit of its being replaced without much difficulty within the preputial covering.

But should these attempts at simple reduction fail, or should the case be already so far advanced as not to warrant their being practised, incision is required. And little more than a scratch suffices, if rightly placed. The general bulge behind the glans need not be widely laid open; but is separated by means of the fingers, into its two component parts. In the depth between these the constriction is found, as a narrow band or thread; and that alone requires division. After reduction, the wound seems a mere notch in the preputial verge.



Fig. 348.

If neglected, the glans may slough, or ulcerate destructively; or the glans remaining merely congested the stricture may cause ulceration of the body of the penis, opening the urethra, and producing urinary fistula. Operating on a case of this

kind, in a boy, after the paraphymosis had existed unreduced for three months, I divided a piece of thread which encircled the penis—deeply imbedded in it—and which had been secretly applied as a jugum, to prevent punishment on account of enuresis.

When paraphymosis and chancres on the glans, or everted mucous lining of the prepuce, co-exist, there is an especial necessity for immediate relief; otherwise, acute phagedæna, or sloughing, cannot fail to supervene. In such circumstances the sores must first be thoroughly destroyed by means of caustic; and the section of the constriction should effect complete division of the whole prepuce; so as to prevent subsequent constriction, and afford every facility for after-dressing of the part. It may happen that the constriction has been slight, and of old standing; and that, in consequence, even after extensive incision on the dorsum of the penis, reduction is found impracticable; the parts being firmly glued to their abnormal site by plastic change. Under these circumstances, we must be content with affording relief to the stricture; completely dividing it by incision; and leaving restoration of the parts to their normal relative positions to be effected when resolution of the inflammatory process has become complete.

Fig. 348. Paraphymosis; the dark portion is the lining of the prepuce, reflected; the preputial orifice, the seat of stricture, is behind, between the two swellings.

Hypospadias and Urethral Fistula.

The former term denotes an imperfect condition of the urethra, at or near its orifice ; the result sometimes of accident or disease, but usually a congenital malformation. The latter applies to deficiencies in any portion of the urethral canal ; and in the perineum is usually found to be the result of sloughing, following extravasation of urine. There may be a vestige of the normal opening at the apex of the glans, the urethra terminating somewhere behind this ; or, as more frequently happens, the anterior portion of the canal—to the extent of an inch or more—appears as if slit up, the margins of the wound having become rounded off ; in other words, the lower part of the wall of the canal is deficient. In extreme cases, the whole antepubal part of the urethra may be thus imperfect. The inconveniences of the affection are—a scattered and ill-projected stream of urine, a flattening out of the organ into a broad thick shelf, which sometimes curves downwards during erection. In some cases this state of matters altogether prevents sexual intercourse ; in the slighter examples it certainly tends to inefficient emission of the seminal fluid ; always causing much uneasiness by exposure of the raw, congested, and very sensitive mucous membrane. When the opening in urethral fistula, or in the slighter instances of hypospadias, is small and circular, the actual or galvanic cautery may be advantageously employed, from time to time, to effect closure. Dieffenbach also recommended stimulation of the margins and surrounding parts by a strong tincture of cantharides. If a stricture of the urethra co-exists, the treatment of this should always be a preliminary measure. When there is rather a slitting up, than a deficiency of parts, the edges should be pared and brought together by silver sutures over a catheter. When the parts are actually deficient, autoplasty must be had recourse to ; a portion of integument being borrowed from the neighbouring perineum, scrotum, or prepuce, and engrafted into the hiatus. The great difficulty in closing an aperture existing in the pendulous portion of the urethra, consists in the tendency to the occurrence of erection during sleep ; and also, though to a much less degree, in the irritation kept up by the passage of urine over the inner aspect of the wound. To avoid the former, a bag of ice should be kept applied to the perineum, or pubes, when the patient is asleep. The latter can always be prevented by making a perineal incision into the membranous portion of the urethra, through which a short catheter can be passed into the bladder, and retained till the wound in front is completely cicatrized. In the minor cases, however, which constitute a decided majority, no interference is necessary ; the inconveniences, if any, being slight.

Hyperspadias or Epispadias.

This is an analogous, but opposite state ; the splitting up—or rather the non-development—having taken place on the dorsal aspect. The chasm may extend from the glans to the symphysis pubis. In general, there is a sufficiency of parts to admit of paring the edges, and approximating them by suture over a catheter. Immediate union is not likely

to occur at every part ; but permanent closure may ultimately be obtained, either by repetition of the operation at the unclosed points, or by occasional application of the galvanic cautery wire.

Imperforate Urethra.

A congenital malformation, in this respect, is obviously to be remedied in but one way ; by endeavouring to find the canal, near the orifice, by an incision carefully made in the lower part of the glans penis. Where a membranous fold seems to occlude the opening, a Bowman's canaliculus-director should be passed through this, and the necessary division of the tissues effected upon it as a guide. Where such incision fails to discover the urethra, it may be opened further back ; but at the worst, the distended bladder having been recognised by the finger passed up the rectum, an incision, made in the middle line of the perineum in front of the anus and extending as high as the apex of the prostate, will enable the surgeon to relieve the retention, and even to pass an instrument forwards along the urethral canal, so that an anterior opening may be made where this is found to terminate. In all these operations, the artificially constructed part of the canal must be kept pervious, by the lodgment of a catheter—changed occasionally to prevent the accumulation of calculous incrustation.

Malignant Disease of the Penis.

This is found only in the aged ; and frequently, as already stated, it may be traced to the irritation of congenital phymosis ; beginning in the preputial orifice, by ulceration, and extending thence to the body of the organ—or, it may be, beginning in the glans itself. The glans is enlarged, indurated, and converted into an irregular cauliflower-looking tuberos surface—epithelioma. The portion longest affected by the disease becomes ulcerated, and discharges a copious fœtid sanies ; the body of the penis suffers likewise ; the lymphatics on the dorsum swell and harden ; the glands of the groin are involved ; retention of urine may ensue, by obstruction near the orifice, or by pressure of the secondary tumours on the neck of the bladder ; the cachexy advances ; and the patient perishes—his end perhaps hastened by hemorrhage from the open and deep cancer.

Nothing but the knife can afford a chance of cure. When the prepuce alone is affected, its removal is sufficient. Sometimes a malignant ulcer attacks the integument of the body of the penis, originating there ; it may be long and successfully resisted in its advance, by the dense fibrous fascia which invests the organ subintegumentally ; and in such a case, removal of the affected surface by dissection may suffice. When the glans and body are involved, nothing short of amputation of the entire thickness affords a prospect of cure—cutting in sound parts, between the disease and the symphysis pubis ; and the attempt is warrantable, only when as yet the lymphatics show no sign of implication. When the glands are already enlarged, there is nothing left in our power but palliation ; and, as formerly stated, puncture of the bladder above

the pubes may be required, towards the close of the case, on account of retention of urine.

Care should be taken not to mistake an extensive induration of the prepuce and glans, the result of a partially or completely healed indurated chancre, or a tertiary syphilitic implication of these parts in an irregularly-knotted mass, for cancer of the organ. Such mistakes have occurred. Ricord mentions one such case. I have myself more than once known amputation resorted to where a well-marked syphilitic eruption upon the surface, and the double glandular inguinal enlargement, should have prevented any such mistake. The mere fact that a man is well up in years does not always prevent him from becoming the subject of the indurated chancre.

Indurations in the Penis.

These may occur in the glans or corpus cavernosum. They vary in their nature, character, and results. In some cases they are undoubtedly cancerous, in others of a tertiary syphilitic kind, in others of the nature of fibro-cartilaginous alteration of the root of the cavernous body. In the first case, they enlarge, are painful, and implicate the inguinal glands. In the second, the history of the case, the softening of the mass, and the good effects of iodide of potassium, prevent any mistake. In the last, the insidious and slow progress of the affection, the absence of pain, and the tendency to ossific change, characterize the disease; it requires no treatment in its fully developed stage; in its early condition mercurial applications have sometimes seemed useful. Inflammatory indurations sometimes occur, producing incapacity of erection upon the affected side; and require ordinary treatment for removal of the abnormal product.

Amputation of the Penis.

This is had recourse to on account of malignant disease, affecting the body of the organ; but only when there is a sufficient space of sound texture between the disease and the pubes, and when the glands yet show no sign of contamination. The ordinary mode of performance is exceedingly simple. The organ, stretched by the left hand pulling it outwards, is lopped off by one sweep of an ordinary amputating knife—laid upon the part, and moved rapidly across from point to heel, or conversely. The integument is encouraged to contract towards the pubes; so that, during the puckering of cicatrization, it may not overlap and interfere with the orifice of the urethra. And this is kept of the normal calibre, by a suitable use of bougies.

Ricord's method of operating is preferable, however, being well calculated to obviate the principal difficulty—namely, tendency to contraction in the orifice of the urethra. Rapid healing of the wound is also promoted; and, at the same time, a sufficient covering is provided for the corpora cavernosa. The procedure is conducted thus: After amputation in the ordinary way—enough skin being left to cover the corpora cavernosa, and no more—the surgeon seizes with forceps the mucous membrane of the urethra, and with a pair of scissors makes four slight incisions, so as to form four equal flaps; then, using a fine needle,

which carries a silk ligature, he unites each flap of membrane to the skin by a suture. The wound heals by the first intention; adhesions form between the skin and mucous membrane; and these textures become continuous—a condition analogous to what is observed at the other natural outlets of the body. The cicatrix then contracting—instead of operating prejudicially, as in the old method—tends to open the urethra, by pulling its lining membrane outwards.

A more satisfactory method has suggested itself to us recently, though no opportunity for putting it in practice has occurred. A narrow-bladed knife is first used to transfix the penis between the spongy and cavernous body, close to the root; the knife having been carried forwards for an inch and a half, its edge is turned perpendicularly downwards, and the urethra and skin flap are divided; the cavernous bodies and dorsal integument being then cut perpendicularly upwards, where the knife was originally entered for transfixion. A button-hole is afterwards made in the lower flap, through which the corpus spongiosum and urethra protrude; while the flap itself is turned upwards, and attached dorsally and laterally, so as to cover in the exposed cavernous structure.

When, in the case of a short stump, inconvenience results from inability to direct the stream of urine in a sufficiently outward jet, the deficiency of the organ may be temporarily compensated, when the patient makes water, by a mechanical adaptation—a funnel-shaped canula, of sufficient length, its base resting on the pubes.

CHAPTER LXIV.

AFFECTIONS OF THE FEMALE GENITAL ORGANS.

THE affections included in this chapter are considered very briefly, the great majority belonging to the exclusive province of the obstetric practitioner.

Inflammatory Affection of the Vulva

Occurs at all ages. In the adult it presents no marked peculiarity in its history or treatment.

In the child, it forms the disease generally called infantile gonorrhœa, or infantile leucorrhœa. This affection, which was long mistaken for the result of attempted impure connection, may occur at any period of adolescence. It is most frequently seen in delicate, unhealthy children; and more among the children of the lower than of the higher classes. Not unfrequently it comes on during convalescence from the eruptive fevers, or during teething.

Sometimes no cause can be assigned; or it may be induced by worms or other rectal irritation, by want of cleanliness, or by exposure of the parts to damp and cold.

The symptoms are, constant irritation and pain, so that the child is frequently moving its hand towards the part; pain and scalding in making water, to which the calls are sometimes inordinately frequent; and, in addition, the ordinary signs of slight febrile excitement.

On inspecting the pudenda, they are found bathed in pus; the whole surface of the vulva is swollen, red, and tender; and there is frequently, on and around the vulva, an eruption of a few red inflaming spots, which may either disappear, or go on to form small pustules. Sometimes the tumid tender nymphæ protrude between the larger labia, producing excessive pain on motion, and usually preventing the patient altogether from walking, except with the limbs considerably apart from each other.

Treatment is simple. In mild cases, nothing but cleanliness may be required. In the more severe, it is necessary to exhibit laxative and alterative medicine, to keep the patient in bed, to allay feverish irritation by hot bathing, to apply locally hot fomentations at the outset, and subsequently to use various washes—as a weak solution of nitrate of silver, or of sulphate of zinc. The decoction of poppies is often useful to remove irritation, and Carron oil frequently affords great relief. Strips of lint, soaked in the lotion or application, should be introduced between the folds of the vulva, in the intervals between the use of the bidet. If the skin is broken, especial care by dressing must be taken, during the healing, to prevent cohesion of the labia.

Sometimes the disease affects children along with a low form of fever ; and the inflammatory process may go on to sloughing. The vulva is also sometimes, in adults, the seat of extensive and unhealthy ulceration, and of *Noma*, with accompanying fever of a low typhoid character.

Abscess of the Vulva

May be the result of mechanical violence, or the secondary consequence of sanguineous extravasation into the subcutaneous or submucous areolar tissue. It may follow erysipelas, or acute inflammatory affection of the vulvo-vaginal glands of Bartholin—arising without assignable cause. Occasionally there is a succession of such abscesses in the vulva ; apparently maintained by inflammatory irritation of the vagina, or of the deeper seated organs. It is a common affection of prostitutes ; and in them frequently ends by forming vulvo-vaginal fistulæ, which may also communicate with the rectum immediately within the sphincter. When the disease is a consequence of sanguineous extravasation, it also sometimes ends in fistula ; the purulent formation extending, like the sanguineous, from the vulva upwards along the walls of the vagina—or in other directions, as towards the anus.

The origin and progress of abscess in this situation does not materially differ in any respect from its history as originating elsewhere. Generally, the accompanying pain is severe ; but if the abscess has followed extravasation of blood, the pain and constitutional symptoms may be comparatively slight.

The affection is distinguished from thrombus by the presence of more or less fever, by the acuteness of the pain and tenderness, by gradual progress of the swelling, by the colour of the integument over it, and by the ovoid or pyriform shape of the swelling, its apex projecting towards the fourchette ; from varicose veins of the vulva, by its sensibility on pressure, by its tension, and by not disappearing when the patient lies down ; from hernia, by the absence of impulse on coughing, its history, progress, etc. There is no special point to be attended to in the treatment. The abscess should be opened early ; and, in preference, from the skin, not from the mucous membrane. Every attention must be paid to the encouragement of free external escape of matter, in order to avert the danger of the formation of fistula. If, in spite of all care, a *fistula vaginæ* does form, and proves tedious, it must be dealt with by free incision including the internal opening.

Thrombus of the Vulva

May be in one labium, or in both. It is most frequently caused by the efforts of parturition ; but may also follow external violence, such as a blow or a kick upon the part, efforts at defæcation, etc. Persons affected with varicocoele of the labia are predisposed to the affection. The thrombus may attain to very large size ; so as, in the case of parturition, to prove an obstruction. Sometimes the large amount of blood extravasated, the progress of the bleeding, and the compression of the urethra interfering with micturition, may demand immediate relief. In such

circumstances, treatment consists in making a free incision, evacuating the blood and coagula, and restraining hemorrhage by pressure ; with or without stuffing of the wound. In the case of accidental wound, risk by hemorrhage is great.

If the tumour is small, it may cause no uneasiness ; and requires no treatment, except the use of cooling and discutient lotions, with rest.

Warty Excrescences of the Vulva

May be situated on the labia, nymphæ, or vestibulum ; or all these parts may be affected at the same time. The growths may be of considerable size ; and when numerous they distend the vulva. They may be of syphilitic origin, but frequently arise from other and simple causes. They are the source of much pain, irritation, and annoyance ; and may produce a quantity of muco-purulent discharge, especially if seated on the mucous membrane. If small and recent, the application of nitrate of silver may disperse them ; or they may be powdered with calomel and chalk. The larger may be removed by strong caustics, as potass, or the acids ; but in most cases it is better to cut them off by scissors—subsequent hemorrhage being checked by cold and styptics. The bulky growths, as already stated, may require a regular dissection for their removal.

Occasionally the whole labia, nymphæ, and clitoris become so hypertrophied, in connection with venereal disease, as to require excision. In such cases, they generally assume the most irregular forms ; sometimes presenting large or small openings, or honey-comb-like irregularities, without ulceration.

Oozing Tumour of the Labium

Is a rare disease. One or both labia may be affected. The part—hard, sulcated, and discharging a watery acrid fluid—is the seat of much pain and itching ; and the neighbouring parts are irritated. Local treatment by caustics, iodine, astringent lotions, etc., combined with the use of laxative and alterative medicine, may be effectual in curing the complaint ; if not, the affected textures must be removed by the knife. But after all this, the disease is apt to recur.

Pruritus of the Vulva

Is a frequent accompaniment of pregnancy, and of disease in the rectum or vagina—especially leucorrhœa. It is more common in advanced life than in youth ; and is a cause of very great suffering. To some women it renders life absolutely miserable. The skin of the parts is generally dry, and often has a rough and cracked appearance ; sometimes it is indurated, and more than usually callous in ordinary sensation. Not unfrequently, there is a rush of small, inflaming, and excessively irritable papulæ over the affected parts ; or there may be spots of chronic eczema, especially on the labia, or aphthous incrustation of the nymphæ and vestibule.

If there is any marked exciting cause, its removal will do much

towards effecting a cure ; and the permanence of the relief may be established. But under other circumstances, the disease generally proves very intractable, especially in those of advanced years.

If the patient labours under irritable bowels from any cause, that must be remedied ; if worms are present, they must be expelled ; if there are piles, they must be cut or tied ; if leucorrhœa exist, its cause is to be inquired into and removed ; if there are pediculi, they must be destroyed and cleanliness enjoined. In general some laxative and alterative medicine is beneficial, more particularly arsenical solution.

Numerous local applications are of service. Among these are—camphor and chalk powder in equal parts ; or calomel, to dust on the part. Simple iced water ; or very warm water ; or infusion of tobacco, with borax or carbonate of soda added ; or Goulard's lotion ; or decoction of poppies, with sugar of lead ; or a weak solution of nitrate of silver ; or camphor mixture, with carbonate of soda ; or diluted hydrocyanic acid ; or solution of borax with sulphate of morphia—as lotions. Among ointments, the diluted citrine, the mercurial, the hydrocyanic, the sugar of lead, are recommended ; as also borax and honey. In many cases Carron oil affords more satisfactory relief than any other application.

Malignant Ulcer of the External Parts

Occasionally shews itself. It is recognized by the ordinary characters of malignant ulceration ; presenting either a dense, hard, ill-defined circumference of cancerously altered tissue surrounding a hollowed out, smooth, ulcerated surface ; or a prominent, warty-looking, ulcerated elevation. In both forms early and wide removal is the only remedy.

Sometimes the labia are found enlarged, and more or less extensively and deeply ulcerated ; forming a disease which, from its intractability, may well be called malignant ; although it has no other character of a cancerous sore. Strong caustics may succeed in producing healing action ; but if not, the knife must be resorted to.

Tumours of the Labia.

In the Labium, fatty tumours are the most common ; easily removable by the knife. Simple enlargement sometimes takes place in one labium, or in both ; constituting a tumour analogous to the Elephantiasis Scroti of the male.

Encysted tumours occasionally form ; when of small size, removable by incision, and evulsion of the cyst ; when large, to be dealt with by regular dissection. Hernial tumours, be it remembered, are also met with in the labium ; recognizable by the ordinary signs, and amenable to the ordinary treatment. Varicocele is also common in this situation.

A Red Fleshy Excrescence in the Orifice of the Urethra

Is productive of intense suffering, on account of the part's extreme sensibility to the urine, and to all external influences. It is easily made to bleed, and is generally about the size of a pea ; sometimes as large as a

small hazel-nut ; usually at the verge of the canal, partially projecting, but sometimes also prolonged upwards into the urethra ; and sometimes it forms a complete circle surrounding it. The only remedy is by excision ; or by simple ablation, followed by the use of an escharotic to repress growth. During healing of the wound, the nitrate of silver is of much use in restraining inordinate sensibility ; applied lightly, every alternate day. But the growth is apt to reappear ; again demanding treatment. In some cases, after removal the reproduction is larger than before, and ultimately a medullary growth develops itself, rapidly involving surrounding parts.

Laceration of the Perineum.

This is a casualty of parturition ; the parts tearing down towards the anus—perhaps with implication of the bowel. The wound is kept clean, and approximation is effected and maintained by adduction of the thighs. Suture in the recent state of the injury is quite improper ; and should in fact be long delayed, as nature generally makes sufficient reparation of the injury. If necessary, the unclosed portion, having had its edges made raw by the bistoury, is brought together by means of silver sutures carried deeply, so as completely to include the whole of the raw surface. Formerly the quilled suture was employed, but our experience of wire sutures leads to the conclusion that this can rarely be necessary at the present day. If employed at all, wire should be used instead of thread, applied according to the ordinary rules. If after (or before) using the sutures, it be evident that the pared edges do not come easily together, then incisions through skin and superficial fascia may be made parallel to the margins of the fissure, and at a distance from it of about an inch, as recommended by Dieffenbach. Latterly it has been suggested by Mr. Baker Brown as more advisable, to divide the sphincter ani on both sides, either before or after inserting the sutures. By this plan muscular traction upon the united edges is annulled. After the operation the rectum should be kept at rest for several days. The urine should also be frequently drawn off in a very careful manner, to prevent any trickling over the pared edges. The sutures should not be removed for, at all events, a week.

Vaginal Fistula.

Of this there are many varieties : Vesico-vaginal, Urethro-vaginal, Vesico-uterine, and Recto-vaginal, being the most common and important ; all the result, usually, of accident in parturition. By an unskilful use of instruments, the parts may be torn ; more commonly by too long delay in the use of instruments the parts are subjected to prolonged and severe pressure by the child's head, and sloughing consequently ensues.

Vesico-vaginal Fistula denotes an abnormal communication between the vagina and bladder. During parturition the parts suffer irrecoverable injury. Two or three days afterwards a slough separates ; if the urine have not been previously discharged, a gush follows ; and afterwards, a draining away of that fluid remains ; or, if there has been a laceration,

there may be a discharge of urine, per vaginam, from the first. The patient is in constant discomfort and suffering. In spite of every attention, congestion and excoriation of the external parts ensue ; and if constant diligence is not applied to maintain cleanliness both of person and dress, the patient's proximity may be noisome to others. As the chasm closes, the discharge diminishes. In some rare cases, spontaneous closure may be complete. In the great majority, an aperture remains ; sometimes such as will barely admit a common director ; sometimes a loathsome chasm, admitting several fingers. The aperture usually is in

the mesial aspect behind the origin of the urethra ; it may be longitudinal, oblique, or transverse. It can be felt by the finger ; and may be best

disclosed by the Marion Sims' duck-bill speculum figured in the margin. In consequence of this canal having suffered other injuries, it may become distorted and irregular ; and the discovery of the fistula, if small, may in consequence be very difficult. Detection is effected by placing a metallic catheter in the bladder, and examining the septum upon the catheter by a finger introduced per vaginam ; or a probe may be passed from the vagina through any sinus, till it come in contact with the catheter. In making this examination, the patient may be placed upon the bed or table resting upon her knees and elbows, with a good light falling directly on the parts ; or the position recommended by Marion Sims may be adopted :—" A few require to be placed upon the knees, with the head and thorax depressed ; but, in the great majority of cases, the patient may lie upon the left side. In this position, the thighs are flexed at about right angles with the pelvis, the right a little more than the left. The left arm is thrown

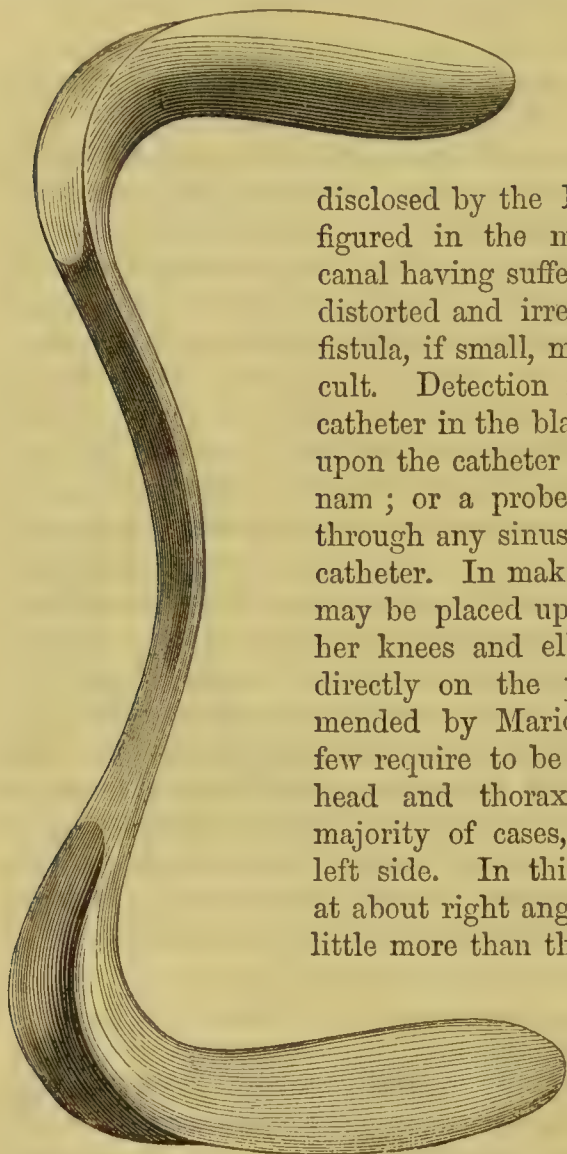
behind, and the chest rotated forwards, bringing the sternum quite closely in contact with the table, while the spine is fully extended, with the head resting on the parietal bone.

The patient being thus rolled

over as much as possible on the front, the assistant, standing at her back, elevates with the left hand the right side of the nates, while the right holds the speculum which draws up the perineum, allowing the pressure of the atmosphere to dilate the vagina, so as to bring every part of it into view."

Urethro-vaginal Fistula denotes a preternatural communication between the vagina and the urethra ; caused, ordinarily, by the imprudent

Fig. 349. Speculum for vesico-vaginal fistula.—SIMS.



use of instruments. In general, the same disagreeable results occur as in the former case. Sometimes there is power of retention ; but, in evacuating the urine, it trickles through the vagina, and over the limbs.

Recto-vaginal Fistula.—Laceration, or sloughing, of the septum between the vagina and the bowel takes place, from the rash use of instruments, or by tearing in the natural efforts of parturition, or as a consequence of sloughing from pressure. In the latter case, the perineum usually suffers laceration also.

Treatment, palliative or radical, should be commenced as soon as possible after the discovery of the disease. The former consists in taking measures calculated to prevent the constant and involuntary discharge of urine ; the latter implies the use of means to close the abnormal aperture of communication. In the advanced stages of cancer of the female organs, these fistulæ frequently are produced by malignant ulceration of the septa. Of course, in such cases, no surgical treatment is admissible.

The Palliative Treatment of the Vesico-vaginal Fistula consists in occupying the vagina by a restraining plug ; attending to cleanliness ; preventing filth, foetor, and excoriation. Probably the best means of occupying the vagina is by a piece of sponge, repeatedly changed ; or by a pyriform caoutchouc-bottle, of moderate size ; enveloped in a piece of oiled silk ; introduced in a state of collapse, and then inflated by means of a nozzle and stop-cock—or by means of such a valve as is used in air-tight cushions. Thus accurate compression is made on the aperture, so as to prevent escape of urine ; and both comfort and cleanliness are obtained. The bottle is withdrawn daily, the air being previously permitted to escape ; at the same time, the vagina may be cleared of accumulated secretion by means of a syringe, and foetor may be removed by a solution of the chlorurets. The bottle, having been cleaned, is replaced.

Immediately after the occurrence of the accident, something may be done to favour contraction of the aperture, and perhaps spontaneous cure. The patient is directed to lie as much as possible on her face ; a catheter is constantly retained—being removed only for the purpose of being cleaned ; a sponge, or some dressing, which must be changed with great gentleness, is placed in the vagina, of sufficient size to exert a moderate closing pressure on the injured part—so as to prevent cohesion of the wound to the walls of the vagina, with consequent complication of the case. Unfortunately, however, the catheter cannot, in all cases, be tolerated, and consequently the benefit of this plan of treatment is lost. The bowels are to be either altogether prevented from moving, or kept gently open, so as to preclude the necessity of straining.

The minor cases have been radically cured by the occasional use of the actual cautery. The part is exposed by means of the speculum ; the iron, at a white heat, is accurately applied to the aperture ; and, at long intervals, the application is repeated. The judicious operator, who wisely seeks only the remote, cicatrizing, and puckering effect of the burn, will seldom, if ever, make the interval shorter than three weeks ; and often even a longer period may be found advisable. At the same time, all avoidable exertion is abstained from, the recumbent posture is maintained as much as possible, the vagina is temporarily occupied by a sponge or other plug, cleanliness is much attended to, and the marital use of the

parts must, of course, be utterly abstained from. Mere fistulæ are quite curable in this way. And in the case of any opening, not of larger size than what is barely sufficient to admit the end of the little finger, cure may be thus attempted. In small fistulæ, the application of lunar caustic every three or four days is occasionally effectual.

Until a comparatively recent period, however, any operative procedure for the cure of vesico-vaginal fistula proved for the most part a failure. Jobert de Lamballe, and Dieffenbach, certainly employed, with a partial degree of success, an elaborate system of quilled sutures, tapes, and extensive accessory incisions to relieve the tension of the line of wound when brought together. In 1849, Dr. Marion Sims, formerly of Alabama, afterwards of New York, and now of Paris, after various unsuccessful

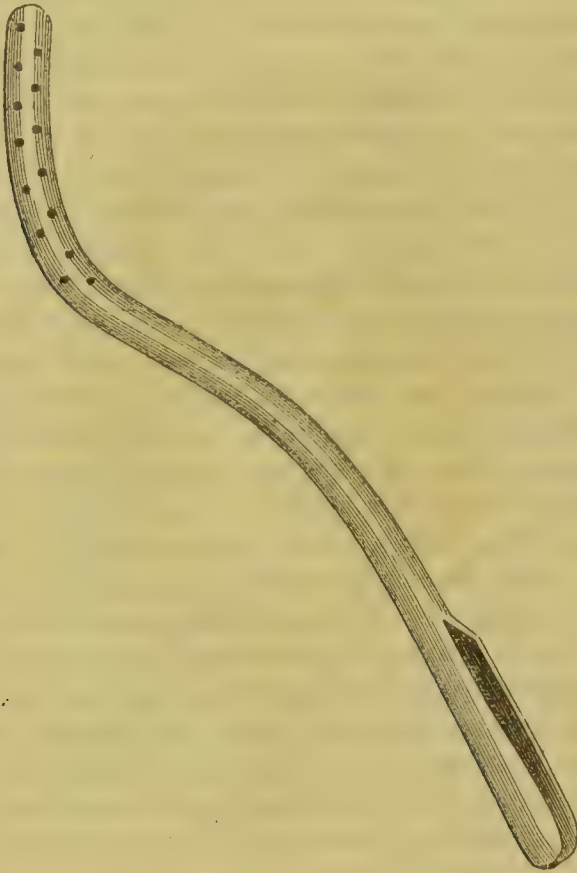


Fig. 350.

attempts to cure this loathsome malady, fortunately conceived the idea of employing silver wire, instead of the silk, linen, or tape sutures which had previously been used—an idea which has been followed by a marvellous revolution in the use of wire sutures in surgery generally, and constitutes one of the greatest advances made in the practical progress of the nineteenth century. Various ingenious and cumbrous contrivances in the way of clamps, buttons, and wire splints, were adopted by Dr. Sims and his early imitators; but at present an almost uniform success, where a sufficiency of tissue remains to admit of the margins of the gap being approximated, follows the use of the very simplest means. The instruments required are—the speculum already

Fig. 350. Catheter.—SIMS.

mentioned; a bistoury, either straight or curved at an angle, set in a long handle; two or three pairs of long artery forceps; a pair of long dressing or porte-aiguille forceps; two or three surgical sewing needles of different curvatures, suited for silver wire, and carrying a wire of No. 28 or 29 of the draw-plate; forceps for twisting the sutures, and a double curved catheter, for retention in the bladder after the operation. (Fig. 350.) By some, a long-shanked fork for supporting the wire while twisting, or a wire-twister, is employed. Neither, however, is absolutely essential. The patient having had the bowels thoroughly evacuated by a dose of medicine, given overnight, and followed by a simple enema on the morning of the operation, is placed in the position described. Chloroform

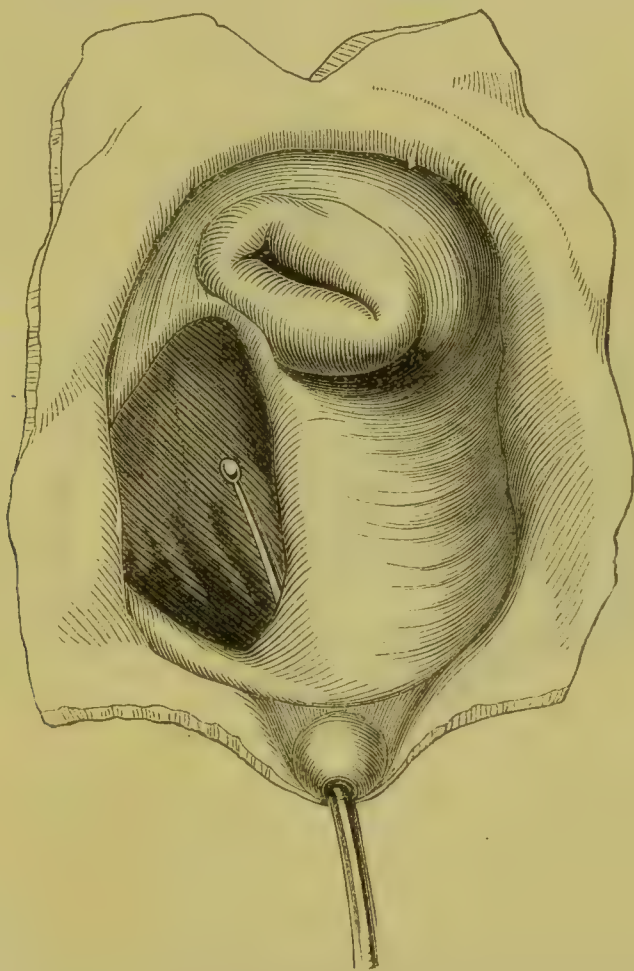


Fig. 351.

may or may not be given; but as the procedure is not so painful as it is tedious, it had better be abstained from. The speculum having been introduced, the mucous membrane of the bladder, if prolapsed through the fistula, is kept out of the way by means of a bougie passed by the urethra. The margins of the opening are then seized by the teeth of the artery forceps, so as to indicate the extent of tissue to be removed by the incision, as well as to make the parts tense, and thus secure smoothness in the section. The cicatricial margin and a small portion of sound texture are removed from the whole extent of the opening; the extremities being so included within elliptical incisions, as to render the

Fig. 351. Plan of the parts, previously to the operation.—SIMS.

surfaces suited to come accurately together in one straight line. When the bleeding has been checked by ice water, the sutures are to be introduced, and should include, on each side, the whole thickness of the vesico-vaginal septum, except the mucous membrane of the bladder. None of the sutures are to be tied till all have been passed. When the aperture is satisfactorily closed, and rendered water-tight, the catheter is introduced, and the patient laid in bed upon her back with a small vessel placed beneath the extremity of the instrument into which the drops of urine may distil. The sutures should not be removed until the eighth day after the operation; and if the twisted ends have been left sufficiently long to be easily seen, and seized by means of forceps, the removal of the stitches is a very easy matter. Where the fistula is extensive, and

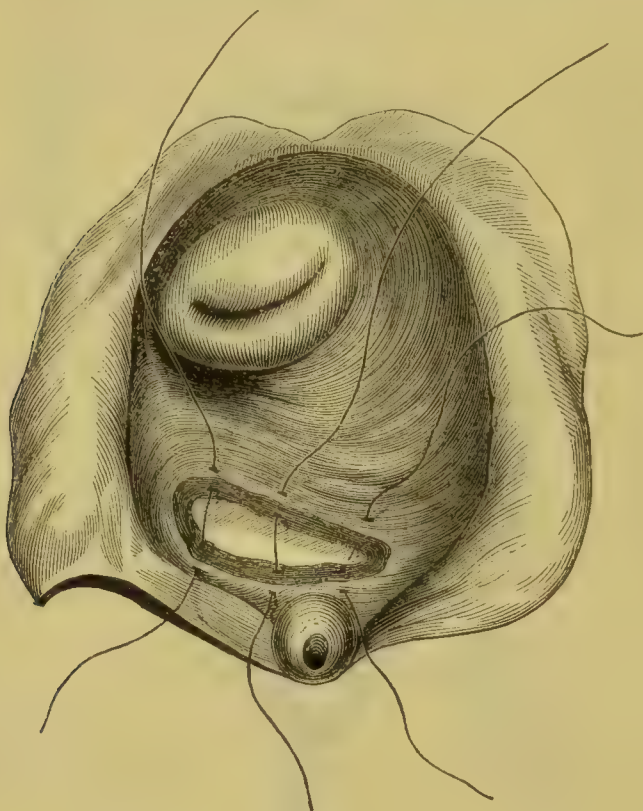


Fig. 352.

implicates the anterior lip of the cervix uteri, the incision and sutures may require to be carried through the tissues of the neck of the womb; or even the posterior lip may be employed to assist in occupying the gap. When the fistulous aperture is very large, and the original destruction extensive, several operations may be requisite, before the fistula is cured; and in some cases, although benefited, complete closure of the aperture may prove impossible.

The treatment of the urethro-vaginal fistula, and of the recto-vaginal fistula, is conducted upon precisely the same principles; but is much more easily executed.

The results of the operative treatment of vesico-vaginal, and recto-vaginal fistula are so satisfactory, in the hands of every surgeon who

Fig. 352. Plan of the operation.—SIMS.

has undertaken the treatment of such cases, since the introduction of silver wire as the suture, that no one need fear to undertake the operation, nor anticipate the occurrence of any difficulty which the most moderate manipulative skill will not suffice to overcome. The use of the actual cautery has accordingly, even in the smaller cases, been very generally abandoned.

Stricture of the Vagina.

This may be the result of previous inflammatory change, indurating the mucous and submucous tissues of a part of the vagina; or it may follow on the healing of a wound received during artificial delivery, or otherwise; or it may be consequent on ulceration, either of a specific character, or produced by a badly arranged pessary. Finally it may be the result of cancerous formation. Under ordinary circumstances, it is amenable to the same treatment, by gradual dilatation, as contractions of other mucous canals. But the surgeon's aid is seldom called for, except during the crisis of parturition; the progress of the child having become obstructed, by an unyielding contraction of the vagina—usually situated at the upper part of the canal, and probably the result of a previous unfortunate labour. In such cases, sometimes, nothing is required beyond considerable patience on the part of the accoucheur; in others, remedial means, such as are used in cases of rigid cervix uteri during labour, are often highly serviceable. In extreme cases the accoucheur's finger or sponge-tents may effect the necessary enlargement. These failing, the duty of the surgeon is, by a probe-pointed bistoury, introduced on the finger, to notch the contracted part at various points—chiefly in the direction of the sides of the pelvis, so as to avoid injury of the bladder or rectum; and then, by progress of the child's head, or by the finger of the operator, complete dilatation is effected.

Obliteration of the Vagina,

To a greater or less extent, is occasionally met with; arising from the same causes as stricture. Then much constitutional disorder must result, from arrest of the uterine discharges; and it is desirable to restore the canal, at least to such an extent as to admit of a due performance of the excretory functions of the organ. The knife, or the trocar, is used, guided in a proper direction by the finger in the rectum; and the bladder is carefully preserved, a catheter in its cavity being manipulated so as distinctly to point out its proximity. The passage made is kept dilated, by means of bougies. If the patient has ceased to menstruate, no operation may be required. Artificial obliteration of the vaginal orifice by operation, was recommended by Vidal de Cassis in severe and otherwise irremediable cases of vesico-vaginal fistula. But recent experience in the treatment of such cases with silver wire sutures proves that this occlusion of the vagina is unnecessary.

Imperforate Vagina or Hymen.

The vagina may seem well formed externally; but on examination,

may be found terminating in a blind *cul-de-sac*, at no great distance from the orifice. In such a case, exploratory incision, such as has been recommended in obliterated vagina, is warrantable, in search of the uterus, in the adult; if, on careful examination, by the rectum and otherwise, there is a tolerable certainty of that organ being present, and that the menstrual evacuations are secreted and retained.

A more frequent imperfection occurs at the orifice; the other parts of the canal being well developed, and in a normal state. The membrane of the hymen may be excessive, and imperforate; or the vagina itself may be shut up, by a more solid and fleshy structure. If discovered in infancy, the thin membrane may be easily ruptured with a probe, and a sufficiently patent aperture provided for after exigencies. In most cases, however, interference is not required at this early age; the malformation may not be discovered until about the time of puberty; and then, on account of non-appearance of the menstrual discharge, and the persistence of uneasy sensations in the pelvis and parts affected by retention of the secretion, attention is directed to the state of the genital organs. The obstructed fluid may be found bulging through a thin membranous septum; or there may, from the thickness of the structures closing the canal, be no bulge or fluctuation. In the one case, simple division of the membrane suffices to establish the normal state. In the other, careful incision is required, as in the case of imperforate anus; and the same necessity exists for afterwards maintaining the proper calibre of the part by suitable means. Immediately after incision, it is well to insure thorough evacuation of the pent-up fluid, washing out the vagina with tepid water, by means of a syringe.

In cases of this kind, the accumulated menstrual fluid may fill and dilate not only the vagina, but also the uterus; expanding the latter as in pregnancy, and causing even some of the equivocal symptoms of that state. The operation of evacuation is not without danger, especially if performed in hospitals; the dangers being by purulent fever and phlebitis. The fluid evacuated is generally dark red, or mahogany coloured, very viscid and grumous; but these characters vary. In a case recently under my care, the distension of the vulva resembled a child's head in size, while the uterus rose nearly to the umbilicus. The patient sought advice on account of the pain, and retention of urine, which were present. On passing the catheter, the urethra, by being stretched over the tumour, easily admitted the finger. I first tapped the vagina with a trocar and canula, and drew off a basinful of fluid; and then, waiting till the uterus had subsided, I freely incised the fleshy hymen in the middle line. The two sides of the incision were kept apart with oiled lint for a few days, and healed separately without bad results of any kind.

Sometimes, adhesion of the nymphæ takes place in children; the opposed surfaces having become raw, on account of neglect of cleanliness, or in consequence of these parts suffering in sympathy with disorder elsewhere, and a purulent discharge having become established. In general the cohesion is slight, and easily broken up by means of the flat end of a probe. For some days, interposition of dressing is necessary, to prevent reunion.

Foreign Bodies in the Vagina.

These may be introduced by the patient herself, under some morbid excitement; or, violently and criminally, by a second party. And they may be of such bulk, or so impacted, as to resist the ordinary means of extraction. By dilatation and lubrication of the passage, and by the judicious use of forceps or lever—or, if possible, of a corkscrew—dislodgment may be effected, without injury of the parts. In difficult cases, division of the impacted substance—or, if that is impracticable, of the sphincter—may be necessary, as in the analogous case of the rectum.

Prolapsus of the Vagina

May exist in various degrees; the dislocated part still remaining in the vaginal cavity, or protruding from it at the vulva. It may be partial or complete. Partial prolapsus consists in the falling down of a part of the vagina; generally either of the anterior wall (vaginal cystocele), or of the posterior wall (vaginal rectocele). Complete prolapsus resembles prolapse of the bowel per anum; the whole circumference of the vaginal tube descending. It is distinguished from prolapsus of the uterus, by the anatomical characters of the mucous membrane of the vagina, and by our reaching the os uteri with the finger passed through and above the swelling.

It is generally accompanied by a feeling of much weight and uneasiness; and often there is considerable irritation with discharge. The functions of the bladder and rectum are more or less impeded or deranged; and if the dislocation has been suddenly produced, there may be obstinate constipation and strangury. It is a complaint extremely distressing to the female; not only causing uneasiness or pain in sitting or walking, but often exciting unnecessary alarm.

The affection is most common in women who have borne many children, or suffered frequent abortions, who suffer from ruptured perineum, or who labour under menorrhagia or aggravated leucorrhœa. In short, anything which tends to relax the parts involved favours its occurrence; not forgetting the influence of deranged general health, and feeble constitution. It may be caused suddenly and kept up by any violent effort, as in coughing, sneezing, laughing, lifting a heavy weight, or straining at stool.

Sometimes removal of the exciting cause—with or without the use of cold and astringent lotions and general tonics—is sufficient to effect a cure. The wearing of an understrap is often beneficial. Sometimes a pessary, in shape adapted to the parts, is enough. But if the case prove incurable and cause much annoyance, it may be dealt with by the knife; carefully dissecting off slips of the mucous membrane of the prolapsed parts, and then bringing the edges together by interrupted sutures; by this means the calibre of the vagina is diminished, and the contraction renders prolapse more difficult. If the perineum is much lacerated, an operation should be performed for its reunion.

The passing of the Female Catheter.

In this operation, great delicacy is required. When, from prolapsus uteri, or other causes, there is much relaxation or change of relative position, ocular inspection may be necessary. But, in ordinary cases, all is done by touch alone, under the dress or bed clothes. The patient should be in the recumbent position, with the nearer thigh flexed. If the surgeon is at the left side of his patient, the fore-finger of the left hand, if on the right side the fore-finger of the right hand, is passed under the flexed thigh, to the upper part of the orifice of the vagina, which is distinguished from the vestibulum by its rugosity; the catheter is so held in the other hand, passed over the thigh, that its length is directed towards the vulva; its point is made to touch a little above the forefinger placed as directed—and, by moving the point downwards, in the mesial line, it slips into the orifice of the urethra. Or, the finger is moved in search of the urethral orifice; which is recognized by feeling just above the vaginal orifice a depression, sometimes with a slight surrounding elevation; and, along the finger, the catheter is then directly introduced. When there is displacement of the parts, a common elastic catheter may be found more suitable than the silver instrument; as then there may be both twisting and elongation of the canal. The ordinary silver catheter should be flat, very slightly curved, about six inches in length, and having some projection or knob near its outer orifice, to prevent its slipping into the canal altogether.

Plugging of the Vagina

Is a most useful and important operation, as a hemostatic, when flooding (not *post partum*) has to be arrested. In every form of hemorrhage from the vagina, it may be of the greatest service; and often is in fact the means of saving life. The simplest and most convenient method of plugging is to use pieces of sponge, or lint, or linen; placing them in the vagina one after the other, every piece being lodged as high as possible. When the bleeding is passive, not many pieces may be required; but if vessels have been opened by operation, the plugging must be done very efficiently; the vagina being well crammed, and a T bandage applied to support the pledgets, which may be previously saturated with vinegar, solution of matico, perchloride of iron, or other astringent and styptic lotion. Great care must be paid to watch against return or persistence of the discharge; and the plug should be carefully removed at the end of about twelve hours; to be replaced, if necessary, with new materials.

Another plan, not so easy of execution, is to pass the centre of a napkin into the vagina; thus making a blind pouch open from without, into which the necessary amount of stuffing may be passed. Or, a bladder may be passed and inflated with air, or filled with refrigerant solutions. Or the same may be done with bags of vulcanized caoutchouc; and some ingenious instruments have been constructed expressly for the purpose.

Leucorrhœa

Is a nosological term, used to indicate a state of disease having discharge of a mucous or muco-purulent character from the vagina as its most prominent phenomenon. Apart from its occurrence as a symptom of almost all the more serious uterine affections, it is the most common of female diseases; and occurs in a great variety of forms.

The *discharge commonly called "Whites,"* may exist without any defined disease in the vagina or uterus, and may be the result of general debility and relaxation of system, especially if in a scrofulous constitution; or it may occur during amenorrhœa. Occasionally it supervenes after the manner of a common catarrh. Often, also, it is a persistent excess of secretion *post partum*.

In such a case, if examination be made by the speculum, no organic lesion may be discovered. Sometimes, however, the mucous membrane of the cervix uteri is found red and injected, or slightly abraded—and a long tag of clear viscid mucus generally hangs from the os. The surface of the vagina is covered by a dense white mucus.

In this, as well as in all other forms of leucorrhœa, the symptoms complained of by the patient may be either few or numerous. They are a class of symptoms common to all uterine affections—viz., disorders of the menstrual function; pain in the back and loins, in the hypochondria, across the hypogastrium, and down the limbs; feelings of bearing down and unnatural weight in the perineum; besides the ordinary accompaniments of disordered stomach and bowels. In most such cases, no local treatment is required. On the contrary, by causing excitement and irritation, it would probably aggravate the complaint. Cold sponging, or the cold hip-bath, with attention to the general health, will suffice. The tincture of cantharides, and the various preparations of iron, taken internally, often seem to have a good effect in diminishing the discharge.

If the case be one of *vaginitis, simple or specific*, there will, in addition to the other symptoms already mentioned, be those of febrile accession, along with much local pain, irritation of bladder, ardor urinæ, pain in defæcation and in walking. The discharge will not be white and mucous, but muco-purulent. In such circumstances, vaginal examination will reveal a preternaturally red colour, and generally a papular or granulated appearance of the mucous membrane, with much tenderness. Treatment consists in maintaining the horizontal position, fomenting or poulticing the parts externally, and internally using a bland or sedative injection; besides employing laxatives, and all the ordinary treatment of gonorrhœa as it occurs in the female. Especial care must be taken against the disease assuming a chronic form.

The most frequent cause of these leucorrhœal complaints, when they come to demand local treatment, is an *inflaming, ulcerated, or otherwise morbid state of the cervix uteri*. The disease may occur in an acute form, but is more frequently met with as a chronic complaint. The symptoms are severer than in the case of "whites," and the general health at length suffers severely. The discharge may vary much in quantity, it may also be of various consistence, it may be muco-purulent or almost pure pus, and it may, or may not, be tinged with blood. If of long con-

tinuance and profuse, it often causes much irritation of the labia externally. Sometimes it is complicated with displacement of the womb, or with chronic inflammatory change, or engorgement and hypertrophy of the whole organ; and these circumstances much retard the progress of cure. All women are liable to such complaints; but the married and child-bearing suffer both most frequently and most severely.

In this brief sketch it is expedient to treat of the numerous, morbid, non-malignant states of the cervix together; more especially when we consider that they cannot in any way be distinguished from each other, without a tactile and visual examination of the implicated parts; and further, that the treatment, in its general features, is similar in all. Passing over with simple mention, the aphthous, herpetic, and other forms of integumental disease, rarely if ever observed, we notice *the simply inflaming and ulcerated cervix*. All the signs of the inflammatory process are present; but pain and tenderness may not be severe. The part may be more or less indurated; and the degree of swelling varies. Sometimes the cervix acquires considerable bulk, is hard and somewhat nodulated; the nodulation in this case being in the form of masses arranged pucker-like around the os. There may then be some difficulty in diagnosis from cancer; the more especially as the weak, pallid, and cachectic appearance of the patient often appears to favour the notion of malignancy. It happens very rarely, however, that cancer of the uterine neck is actually mistaken for hypertrophy; for the former is generally found, even on a first examination, to be in an advanced state. At the same time, it is to be remembered that chronic inflammatory change with hypertrophy is not unfrequently mistaken for malignant disease; and sometimes even the most experienced find a difficulty in diagnosis, till the result of treatment has been ascertained. The following points are distinctive in most cases. In cancer, there is the peculiar cachexy of system; and the morbid product may extend from the cervix more or less over the roof of the vagina, rendering the uterus fixed in the pelvis. There is generally intense induration, with irregular nodulation; and if there be ulceration, the indurated points projecting into it are friable under the finger; the ulceration is deep and irregular in form; and the discharge is frequently foetid, watery, grumous, and sometimes mixed with blood.

In inflammatory affection of the cervix, the accompanying ulceration most frequently attacks the posterior lip; and may be of various kinds; simple or healthy, indolent, irritable, or weak.

The cervix uteri is also liable to *a granular form of inflammatory change*. The part is tender and red, having the mucous membrane abraded or superficially ulcerated over a great part or the whole of its surface; and bears numerous red points. These are the larger papillæ engorged, and projecting, from being denuded of the thick epithelial layer in which they are naturally buried. Generally, the part is also somewhat enlarged; and frequently, in this case, the vagina is irritated, or more or less inflaming around the cervix.

When the ulceration is healthy, and there exists no complication, it is easy to effect a cure, by enjoining rest of the parts, and using any simple detergent or mild astringent lotion. If it has been protracted in duration, or is unhealthy in its character, the lunar caustic may be used

through the speculum, every third or fourth day ; care being taken to secure its proper application, by cleansing the parts with a small sponge or dossil of lint, previously. In all forms of inflammatory affection of the cervix with ulceration, this is one of our most useful resources ; and in most cases, along with proper regulations as to rest of the parts, and attention to the general health, it is successful. If the ulceration prove obstinate, however, other means may be tried ; as the local application of sulphate of copper, nitric acid, the acid nitrate of mercury, chloride of zinc, caustic potass, or potassa cum calce, or even the cautery, with all care as to the necessary precautions against the caustics injuring the neighbouring parts, or penetrating too deeply. After the ulceration has been healed, it is generally necessary to continue the adjuvant treatment for a considerable time ; and to check the leucorrhœa which may persist, a variety of astringent lotions may be used, as circumstances demand. Among these may be mentioned the simple douche of cold water, injected into the vagina for a few minutes, once or twice a day ; the use of strong infusion of green tea, with some borax added—eight or ten ounces being injected morning and evening ; the use of decoction of oak bark in the same way, or of weak solutions of sulphate of zinc, alum, acetate of lead, or of nitrate of silver in small quantity.

Sometimes the application of two or three leeches to the cervix, through an ordinary speculum, is useful to dispel the inflammatory irritation, and to remove local congestion. During the painful stage the belladonna ointment ball, with chloroform, or a continuous stream of carbonic acid gas, forms an excellent sedative. And the application of iodine in tincture through the speculum, or its use in the form of iodide of lead ointment introduced into the vagina in the form of a ball covered with a thin coating of wax, is often advantageous in dispelling hypertrophy.

The most intractable cases are those where the disease is chronic, and where there is great enlargement of the cervix. In these, there is frequently a degree of engorgement and hypertrophy of the whole uterus, as well as displacement of the organ ; and although reduction of the size of the cervix, and arrest of the leucorrhœa, frequently remove the entire affection, there constantly recur cases where this does not happen and the symptoms of uterine disease persist. In such circumstances, the progress to cure is often tedious, and treatment must be directed to the sub-inflammatory engorgement and hypertrophy of the womb, and to the general health, simultaneously. In reducing the enlarged cervix, it is sometimes necessary, in addition to the means already described for the cure of ulceration, to resort to more heroic means. After destroying a part of the diseased surface by means of strong caustics, absorption and disappearance of the remaining portion are induced. For this, various plans have been recommended ; such as the careful application, through an ivory speculum, of a cautery at white heat. Thus a slough is produced, and a healthy ulceration may follow ; the remedy being afterwards repeated or not, according to circumstances. The application of potassa cum calce has also been advised ; but a more efficient and satisfactory plan is to apply freely to the most indurated part the potassa fusa, through a glass speculum ; guarding the neighbouring parts by

irrigating them immediately and abundantly with dilute acetic acid strongly injected.

Leucorrhœal discharge may come from the os uteri, and be due to some diseased condition of the follicles of the cervical cavity or uterine interior; in some instances, again, produced by partial retention of the placental or other structure of an abortion, and in every case remaining so long as such causes continue to exist. The sponge-tent should be used in all cases when the cause of the discharge is with difficulty diagnosed; both for the purpose of accurate examination, and also in the way of treatment, by affording a free escape for the secretions. Injections of chloride of zinc, and the application of nitrate of silver to the cervical or uterine cavity, by means of a porte-caustique, will frequently be found useful.

Inversion of the Uterus

Is the turning of the organ inside out; and it may happen in various degrees. It has been observed to occur idiopathically even in the virgin; and in a minor degree is probably a not unfrequent concomitant of polypus springing from the body or fundus of the womb. But the great majority of cases occur soon after delivery, in consequence of improper treatment after the birth of the child; and occasionally the accident happens spontaneously at this time. Into these details this is not the place to enter. It is sufficient to state that if the organ be not reduced very soon after displacement has occurred, it will speedily become irreducible. If death do not quickly follow, the case becomes one of chronic inversion, which, inducing as it does large losses of blood, and exhausting discharge, with rectal and vesical irritation, is the cause of constitutional disorder so serious as to suggest the propriety of completely removing the inverted organ. The statistics of the operation are not sufficient to found a decided opinion upon; but they are encouraging, when we consider the gravity of the complaint. The surgeon has to decide whether his patient's best chance lies in tolerating the disease and combating its effects, or in submitting to the risk of operation. On the one side, there is a grave disorder which frequently proves fatal, by exhausting the patient—if not more directly; and on the other, we have the favourable experience of numerous surgeons who have practised extirpation of the part.

It is sometimes difficult to diagnose this affection from polypus; but in general it can be made out with great certainty. In inversion, we observe the absence of the body of the uterus from its natural position; a state of matters as easy to determine in the thin and relaxed female, as it is difficult under the reverse condition. There is a tumour in the vagina, sensible or even tender, and the handling of which is liable to induce sickness; it is roughish on the surface, dark in colour, easily made to bleed, regularly rounded in form, and with the base larger than any other part; or only moderately constricted, by the cervix; having little mobility; and occasionally, if prolapsed, showing the openings of the Fallopian tubes, into which a stilet may be introduced. If the finger is passed above the inverted parts, it first reaches the cervix, encircling the base of the tumour; and the finger or bougie introduced

between the cervix and the tumour quickly reaches the end of a cul-de-sac all round the latter. Further, the history of the case is peculiar. The reverse of almost all these points is predicable of a polypus; and some of them, if certainly made out, are quite distinctive.

When inversion is partial and the result of polypus, it will probably disappear spontaneously on removal of the cause. In an ordinary case of chronic *post partum* inversion, an attempt should be made to reduce it by direct pressure; the patient being anæsthetized; premising the use of warm baths, local bleedings, purgatives, etc. If this fail, and extirpation of the organ is recommended, it is sufficiently easy of execution. The womb is drawn down between the labia by forceps, and a very tight ligature is applied around it below the cervix, care being taken that no intestine has descended into the inverted organ. Or the mass may be transfixed by a double ligature, and tied in two parts. Or a metallic ligature may be thrown around it; and by the aid of Gooch's double canula, or other similar instrument, this may be gradually tightened till it cuts its way through and separates the whole. It occasionally happens that the already existing constriction at the neck of the womb is such as to cause sloughing without surgical assistance.

Prolapsus of the Uterus

May be partial or complete; the former term indicating an abnormal approximation of the uterus to the os externum vaginæ; the latter denoting that the organ lies in part, or in whole, without the os externum, forming a tumour between the patient's thighs. The affection may occur at any age; but increases in frequency with the advance of life, as well as according to the number of labours. Small tumours in the uterus, or the pressure of large tumours upon it, menorrhagia and leucorrhœa, are local predisposing causes; as also relaxation of the vagina, from whatever cause, and largeness of the pelvis. It is met with in every rank of life; but when in a very aggravated state, is most frequent in the lower classes—especially in those unfortunate women whose avocations require much straining and effort; not only predisposing to the disease, but also aggravating it when it exists. It may occur at any stage of pregnancy, or through it all; and even during delivery at the full time—but this rarely.

This condition is easily distinguished by finding the os and cervix, and ascertaining that the former leads into the cavity of the organ. Partial prolapsus is extremely frequent in its occurrence, is easily replaced in most cases, and seldom causes any serious disturbance. In complete prolapsus, also, the tumour is generally easy of replacement; sometimes, indeed, it resumes its natural position spontaneously, when the patient lies down. But in aggravated cases, replacement may be a matter of some difficulty from various causes. Of these, congestion and inflammatory change are the most important. In some cases, this latter has been so intense as to end in gangrene and separation of the parts; resulting in either death or cure of the patient. When the prolapsus is large and of long standing, it may be quite impossible to replace it. The uterus, carrying with it the bladder and rectum, becomes swollen

and condensed ; and forms a large pouch, containing other viscera prolapsed into it ; in this state resembling an old and large hernia, the contents of which can with difficulty, if at all, find room for return to the abdominal cavity. In such cases, the protruded parts generally present large and unhealthy patches of ulceration ; and the corresponding portions of the thighs are more or less irritated and excoriated.

Prolapsus of the uterus is generally the cause of much undefined suffering in the region of the pelvis. Patients complain of distressing feelings of bearing down, weight in the perineum, dragging in the loins ; and there may be much disturbance, or even temporary arrest of the functions of the bladder and rectum. Often there is difficulty in walking. In cases of complete descent, great uneasiness is of course produced by friction of the thighs upon the tumour ; and the irritation caused by the trickling of urine over the parts is sometimes extreme—often ending in unhealthy ulcerations. There is also, occasionally, derangement of the functions of the stomach.

The complaint is sometimes complicated by hypertrophy or tumours of the uterus or of the ovaries, by ascites, by polypus of the uterus, by leucorrhœa, by menorrhagia, or by calculus in the bladder.

The objects of treatment are threefold. 1, To replace the organ ; 2, To retain it in its proper situation ; and 3, To protect and support it when it is irreducible.

The replacement, as already remarked, is frequently effected without aid, on the patient assuming the recumbent posture ; or, it may be done with more or less force directed against the tumour, always in the direction of that axis of the pelvis through which it is at the time passing. If any difficulty is apprehended, care must be taken to secure complete evacuation of the bladder and rectum before the attempt is made. Sometimes, from the causes already enumerated, it is for the time at least irreducible. But continued maintenance of the horizontal position, and the use of local antiphlogistics if necessary, will generally restore reducibility. In some rare cases of long standing, the reduction, although easily enough effected, cannot be tolerated by the patient ; and in others reduction is altogether impossible.

When the case is recent, and produced by violence, simple reduction, with maintenance of the horizontal position for a few days, will be sufficient. In some examples, it is necessary, in addition to this, to use means to restore the tonicity and contraction of the relaxed and extensile vagina. For this purpose, frequent irrigation of the canal with cold water, or continued use of astringent ointments and lotions, is very serviceable. Attention must be at the same time paid to heal up ulceration, and to remove leucorrhœa. In most cases, however, the use of a pessary is required. It may be either worn constantly, except when removed for the sake of cleanliness for a few minutes ; or it may be laid aside during the night. It should always be as small as is consistent with efficiency ; the size ranging according to the conditions of the case. If the perineum is much injured, a bandage may be necessary to retain the pessary. And this must be kept clean, by removing and replacing it ; with a frequency varied according to the material of which the pessary is made. A great deal has been written concerning the material

of the pessary, and its shape. Different practitioners are in the habit of using different forms, and it not unfrequently happens that after trying several, the patient herself is the best judge of what is most suitable. The ball pessary of boxwood is one of the most useful ; the ring pessary is often recommended to married women, but requires watching lest the cervix uteri pass through the ring and become strangulated there. Pessaries more or less cup-shaped, and having a stem attached, are particularly applicable to those cases where the destruction of the perineum renders a bandage necessary. They have the advantage of not distending the whole vagina, as ball pessaries do, and thus preventing that tonic contraction of this canal, which has so much to do with the retention of the organ in its proper place. Of late, gutta percha has almost superseded every other material in the manufacture of pessaries ; and the fiddle-shaped ring pessary made of gutta percha has proved specially advantageous in securing a satisfactory support of the uterus without pressing unduly upon the cervix, or on the anterior and posterior walls of the vagina.

In some cases the wearing of the instrument eventually effects a cure ; but in others, dependent on relaxation, it may prevent that result ; and in these it should not be used till other remedies have been tried in vain.

In all cases, the utero-abdominal supporter of Hull, or some of its numerous modifications, is very useful ; if no special cause exist to prevent the patient wearing it. By supporting partly the weight of the bowels, it lightens the pressure upon the womb ; the padded under-strap, pressing firmly upwards on the perineum, counteracts the prolapse from below ; and the machine gives general support and a feeling of security to the patient.

Operative interference has been resorted to in aggravated cases, and not without some success ; it is most applicable to those not exposed to the risk of childbearing. The labia have been made raw, and adhesion between them effected, so as to occlude the vagina, excepting a small passage for the vaginal excretions. *Episoraphy* has also been successful ; it consists in carefully paring off longitudinal slips of the mucous membrane of the vagina, and uniting the edges of the wounds by the necessary number of interrupted sutures. When rupture of the perineum co-exists, a horse-shoe-like portion of mucous membrane should be removed from the vaginal orifice, the centre corresponding to the posterior fourchette ; after which the raw surfaces should be brought into accurate apposition by means of wire sutures. Cauterization by the hot iron, or the mineral acids, has also been resorted to for the same purpose. In some cases, by the probe director or uterine sound introduced into the os uteri, the cavity and cervix are found greatly elongated. When this is due to great enlargement of the cervix uteri, that part may be excised with the view of reducing the bulk of the protruding mass ; and the retention of what remains will thus be more readily effected.

Finally, if reduction is impossible, a protecting and supporting truss must be adapted, after the manner of a suspensory bandage.

Displacements of the Uterus.

This organ is frequently found lying in an abnormal position. It may be dislocated *en masse*, or its body may be displaced in regard to the cervix ; and the most common malpositions are either backwards or forwards, forming, in the one case, an *antiversion* or a *retroversion*, and in the other an *antiflexion* or a *retroflexion*. These changes are sometimes congenital, and may be simple or complicated. Frequently they co-exist with tumours, chronic metritis, hypertrophy of the womb, leucorrhœa, or ovarian irritation. When uncomplicated, they may cause no painful symptom whatever ; but sometimes they produce great difficulty in standing or walking for even a short time, disturbance of the functions of the bladder or of the rectum, a feeling of weight and bearing down, a sense of pressure at the anus, pain on going to stool, as well as many of those numerous neuralgic and other symptoms which accompany all the chronic uterine affections.

On passing the finger to the roof of the vagina, the cervix uteri is found more or less displaced from its natural position ; and a hard, often tender, rounded tumour is felt through the vagina. This is observed to move with the cervix, and may be traced to be continuous with it. In thin and relaxed women, it is possible during examination, by placing the free hand over the hypogastrium, and using the necessary palpation and pressure, to feel exactly the position and relations of the entire organ.

The affection may be farther diagnosed by introducing a bougie or probe into the cavity of the organ, and ascertaining its entrance into the tumour felt through the roof of the vagina. Generally, by means of the probe, the fundus uteri forming the tumour can be depressed or removed from the finger by replacement.

Treatment consists in removing all local congestion and inflammatory affection, combating uterine hypertrophy and engorgement, and arresting leucorrhœa ; in short, abstracting, as far as possible, everything which can be regarded as a cause of the production or continuance of displacement. Maintenance of the horizontal posture, for a length of time, is often of great service as an adjuvant. In some cases, the vaginal, and in others the intra-uterine pessaries may be tried with caution. But, in the majority of cases, they are worse than useless.

Stricture of the Cervix Uteri

May be congenital, or may result from inflammatory engorgement and induration. The stricture, if congenital, is generally at the os externum, or at the os internum. If acquired, it may be found at any part of the cervix, or may partially close up some extent of it. It is of rare occurrence ; but when present may be the cause of dysmenorrhœa, and sometimes it prevents conception. It is discovered by the symptoms of dysmenorrhœa ; or, physically, by the difficulty of passing even a small probe through. Every case, however, where a probe cannot be easily passed, is not therefore to be considered a case of stricture. There may be obstacles to passing a probe into the cavity of the uterus, from many

other causes ; as flexion or version of the uterus, the presence of tumours, and difficulty of adjusting the probe to the direction of the long axis of the neck and cavity of the organ.

Treatment consists in dilating the cervical canal. This may be effected by a succession of bougies, or of small pessaries with an intra-uterine stem, as is done in stricture of the urethra or rectum. The instrument, however, may be safely left longer *in situ* than in the cognate affections. In fact, it may in some cases be left for days with safety.

If the disease is inflammatory in its origin, however, the pessaries would merely irritate, without producing benefit. In such cases, especially if there is any engorgement, it is better to trust to the ordinary treatment of an inflaming and hypertrophied cervix.

Of late, it has been recommended to use the bistouri-caché, or the uterotome of Dr. Simpson—a similar instrument, adapted to this particular case. By means of this, the stricture is divided from within outwards ; the blade being made to project only to a small extent. If the neck is small, the incision must be proportionally diminished ; as there is danger from dividing the vascular trunks which lie on the peritoneal aspect of the proper tissue of the cervix.

Uterine Polypus.

Uterine Polypi may be of various structure. Before their removal we can in some cases determine their pathological nature by their consistence, by their seat of insertion, by their size, by their history, and by the concomitant symptoms.

The size of the polypus may vary from that of a millet-seed, to that of a child's head. In fact, their growth is limited only by the capacity of the pelvis. The largest tumours are fibrous in their structure. The mucous vary much in size ; they often are formed by the enlargement and projection of Nabothian follicles, and then contain cavities filled with the glairy secretion of these bodies. Sometimes, the mucous polypus is so small and sessile, as to be with difficulty discovered.

The insertion of these tumours may be at any point on the internal surface or os of the uterus. Very rarely, they are found implanted in the vaginal walls ; either having originally sprung from that part, or, as still more seldom happens, having formed a second insertion by adhesion. Polypi have sometimes been observed growing by two roots from the uterine walls—the roots having an identity of structure ; and sometimes the second root is merely the accidental result of adhesion.

A polypus may be inserted by a pedicle or stalk ; or it may be sessile. The pedicle may be of any thickness ; it may be several inches long ; or its length may be inappreciable.

Sometimes polypi are found projecting from the vagina, suspended from the uterus by a long slender pedicle. These have been designated by French authors "*polypes à pendule* ;" and are generally observed in women considerably advanced in life, in whom the polypus has grown without occasioning much if any annoyance.

While mucous polypi may spring from any part of the internal sur-

face of the uterus, and not unfrequently several may be met with at the same time in the cervix, or adhering to the os—the fibrous polypus almost invariably grows from some part of the body of the organ.

The most urgent symptom of the affection is loss of blood. This is the chief source of the mischief which the tumours produce; and the consideration of its arrest is generally what leads to their discovery. It rarely happens that a woman dies directly of loss of blood from this cause; but there frequently results an extreme state of anemia, leading ultimately to a fatal termination. Violent, and sometimes fatal *post partum* hemorrhages, are occasionally connected with this as a cause.

Bleeding may take place at the monthly periods, or at irregular intervals. It is frequently brought on by long continuance in the erect posture, by exertion in walking, or by jumping from a height; or it may occur without any assignable cause. It may in its flow resemble the ordinary menstrual discharge; or the blood may issue in a continuous stream from the vagina. The quantity lost has no constant relation to the size of the tumour. The fibrous polypus is generally believed to be the most frequent cause of serious hemorrhages; but these may occur with polypi of any kind, even the smallest. Further, in some cases, there may be no bleeding at all; there may even be amenorrhœa.

In the intervals of hemorrhage, there may be no discharge from the vagina. Generally, however, there is a mucous or muco-purulent secretion; and in cases of large polypi, this is often abundant. Sometimes it is mixed with blood; occasionally it is very foetid, especially if the polypus is ulcerated or breaking up. When the growth is intra-uterine, the blood may sometimes be observed distilling from between the lips of the cervix.

The other symptoms accompanying polypus need no particular description. They are those common to all affections of the uterus. Occasionally, one of these symptoms is very prominently complained of; as pain in the hips, verging to sciatica; also pains in the mammae.

Examination with the finger generally discovers the growth. If, however, it be very small, care may be required. Sometimes a smooth, soft, and easily movable polypus, with small pedicle, remains undiscovered, although of considerable size; the finger always pushing the growth before it, instead of passing round it, as in general is easily done. If the tumours are small, and lodged in the cervix, they may be better exposed after dilatation of this, by means of a sponge tent. By the same means, an intra-uterine polypus may be detected. The speculum also may be used to expose a polypus for examination by the eye. But, it may be added, that these growths not unfrequently cause no inconvenience whatever; and are discovered only by accident.

Polypus is distinguished from cauliflower excrescence, by the latter having a broad attachment to the cervix, by its free bleeding when touched, by its profuse watery discharge, by its rough and largely granular surface, by its accompanying cancerous cachexia, and lastly, by the results of treatment. Polypus is also liable to be mistaken for inversion of the womb.

The treatment of uterine polypus consists simply in effecting its removal. Bleeding has the same treatment as other forms of uterine

hemorrhage unconnected with labour. If violent, and proving dangerous, it may be commanded by the plug. If slighter, it may be arrested by placing the patient in the horizontal posture, keeping her cool, applying cold locally over the vulva and hypogastrium, administering cold enemata, or, in some cases, cold and astringent vaginal injections, cautiously, and using internally the common astringent and refrigerant medicines. As in many other hemorrhages, opium is of service.

Removal may be effected in various ways. The quickest, and in most cases the best plan, is the direct use of long scissors, slightly curved on the flat, through the speculum—or without it, using the finger, or fingers, as a guard. When the polypus is large, and can be well seized by a volsella, it may be dragged down to the vulva, and its stalk divided there by knife or scissors. If the growth be very bulky, it may be necessary to enlarge the vaginal opening by incisions. When the stalk or base is large and broad, it is safer to cut near the tumour, rather than near its insertion; on account of the danger of incisions implicating the uterine walls. If difficulty is felt as to the proper site of the incisions, it is preferable to use some of the slower, but in this instance safer methods of removal. And in all cases it is to be remembered that it is not necessary to take away the whole pedicle; for the part left after separation of the polypus quickly disappears. After removal there is rarely any alarming hemorrhage; but it must be carefully watched for, and early arrested, if need be.

Small polypi may often be conveniently removed by torsion and avulsion, the operation being the same as for nasal polypus.

A ligature of whip cord, or silver wire, may be thrown around the pedicle, by means of Gooch's well-known double canula, or by any of the numerous modifications of it, in the form of *ecraseurs*, which best suits the operator's fancy. In the former case, removal is a gradual process, occupying days; in the latter, occupying but a few minutes. In cases where a great number of small polypi exist within the uterine and cervical cavities, the uterine scraper may be advantageously substituted for forceps.

In the case of the fibrous polypus, direct use of the knife is perhaps, upon the whole, the safest method; as most of the other modes are tedious, and on account of continuance of foetid discharges from the half separated and decaying polypus, as well as from the irritation of the ligature, there is risk of untoward inflammatory mischief being excited—perhaps pyæmia.

Small, sessile, mucous polypi may be destroyed by nitrate of silver; or a stronger caustic may be used, if necessary.

Extirpation of the Cervix Uteri

Is performed chiefly in cases of malignant disease still confined to this part, and when the peculiarities of its site, and its prominence into the vagina, render complete removal feasible. The operation is sufficiently simple; the only point requiring particular care being to keep the incisions in the cervix below the peritoneal reflections—at the same time removing as much as can safely be done.

The patient is laid on her back, in the position for lithotomy ; or flat on her face, with the hips raised, and the legs dependent. The cervix is seized by strong hooked forceps, and gently but determinedly dragged downwards, till it appears at the os vaginæ, through which it is at length drawn. If the patient has never borne children, or if the os vaginæ be small and contracted, it may be dilated by one, two, or three small incisions, made either posteriorly or laterally. The labia are now to be kept separated, and out of the way of the knife, by copper spatulæ, bent into a convenient shape. After the cervix has been drawn down, the insertion of the vagina is made out, in order to judge of the position of the peritoneal reflections, and to avoid including the bladder in the incisions. The necessary amount is then taken away, either by large and powerful scissors, or by the probe-pointed bistoury. Our chief confidence for the arrest of hemorrhage is to be placed in the use of compresses soaked in the perchloride of iron ; or, to prevent all risk of bleeding, the ecraseur may be employed instead of cutting instruments.

The amount of blood may be inconsiderable ; or a large quantity may be lost. And it may happen that a case, otherwise adapted for the operation, may be unable to bear, without the greatest risk, even a small loss of blood. Under such circumstances, a modification of the operation may be resorted to. After dragging down and exposing the cervix, it may be encircled in a strong ligature ; or it may be transfixed, as often as may seem fit, by a needle armed with a double ligature ; the different portions being separately tied. And the part below the ligature may then be excised with safety.

Malignant Disease of the Uterus

May assume one of three principal forms ; the corroding ulcer, malignant ulceration without much interstitial cancerous product ; the cauliflower excrescence, springing from the cervix ; and the common cancer of the uterus, which may be scirrhus or encephaloid, very rarely colloid.

The *Corroding Ulcer* is not a common affection. It is distinguished from simple ulceration by its irregular surface, by the fœtor and profuseness of the discharge, by the occurrence of hemorrhages, by the nature of the pain, which is generally severe and lancinating, by the unhealthy malignant local characters, and by the presence of the malignant cachexia of system. From ordinary cancer of the womb it is easily known, by the want of extensive induration, by the mobility of the womb ; and often, though not always, want of tenderness to touch is also distinctive. As it advances, it consumes or corrodes the tissues ; spreading into the uterine cavity ; attacking and destroying the recto-vaginal, and vesico-vaginal septa.

The disease is irremediable. But attempts have been made to arrest its progress while the cervix alone was implicated, by excising that part in the usual way. Frequently, the use of caustics seems to retard advance, to improve the nature of the discharges, and to diminish the tendency to repeated hemorrhage. For this purpose, the pencil of lunar caustic, or of chloride of zinc, and the actual cautery, are of most service. The extreme fœtor of discharge is to be corrected by copious use of the

chloride of zinc lotion, of solutions of the permanganate of potash and iron, or of the carbolate of lime, upon the recipients of the discharge, and as a lotion ; used very gently internally, if there is little tendency to bleeding. A weak solution of the chloride of soda is also suitable for this purpose. In addition, all the general rules for the palliation of cancerous disease are here applicable.

Cauliflower excrescence is also an unfrequent complaint. It consists in the projection of a malignant mass, which may be of various shapes, into the vagina. It springs from the cervix, and generally has a large base. It is covered by a number of small pedunculated bodies or granulations, which are often in bunches, and may give the general appearance of a head of cauliflower. It is of a bright red colour, and easily made to bleed. The general symptoms are those of ordinary cancer of the uterus, but less severe ; the watery and bloody discharge is usually excessive in amount. On examination, a tumour is discovered, with the characters above stated ; it is felt to be movable and polypoid ; and if the disease is in an early stage, the uterus also is not fixed. It is to be distinguished from the polypoid masses of encephaloid which sometimes grow from the interior of the cervix, but along with which there is much diffused cancerous infiltration. If the excrescence be the sole discoverable malignant affection, and if there be every reason to think that it might be completely and favourably extirpated, the operation of excising the cervix should be at once performed. And during healing of the wound, care should be taken, by the use of caustics, to procure healthy cicatrization, and prevent, as long as may be, any tendency to repullulation of the growth. In numerous cases the operation has been successful in procuring complete relief, and apparent cure—at least for a very considerable time.

During the course of the disease, cold and astringent lotions are sometimes of service in checking the amount of discharge.

Cancer of the Uterus occurs at all ages ; but increases in frequency from the period of puberty till the end of menstrual life. It presents itself most frequently in the form of diffuse scirrhus formation, and more rarely encephaloid.

The scirrhus formation generally commences in the neck, and spreads from thence ; the encephaloid more frequently attacks other parts of the organ first, and sometimes forms projecting and polypoid masses in the vagina, or on the cervix and body of the uterus ; it is softer to the touch, and probably gives rise to bleedings at an earlier period. With encephaloid, too, there is more enlargement and hypertrophy of the non-cancerous parts of the organ, than with scirrhus. It sometimes but rarely happens that the vesico-vaginal or recto-vaginal septa are first affected with malignant product—the disease spreading from thence to the cervix uteri.

At the outset, there is frequently much ill-defined derangement of the general health, which proves but little amenable to treatment, and often distracts the attention of patient and practitioner from the real seat of disease. And even when the malady has made some progress, but is still in an early stage, the distance of the severest pains from the womb, their lancinating and neuralgic character, and the small quantity,

or even unusual absence, of discharge, may deceive. But as soon as ulceration is established, the nature of the discharges and their mixture with blood at once give the alarm.

Patients frequently suffer from pain in the mamma, also in either the right or left hypogastric region, of a wearing kind, with frequent recurrences of stabbing and lancinating shoots ; also from fixed pain, often of a burning kind, in the region of the womb ; from pain in the back ; from pain and restlessness in the legs ; from pruritus of the vulva, and irritation of the bladder ; also from constipation, and feeling of bearing down or pressure upon the anus. These sufferings may continue during all the course of the disease, or may be at different times substituted the one for the other.

Before active ulceration commences, there may be no discharge ; or there may be a secretion of thin, serous, acrid fluid. Sometimes, even when there is superficial and slowly progressive ulceration, there may be little or no discharge ; as is sometimes seen in cases of open scirrhus of the mamma. But, in general, as soon as ulceration commences, there appears a large quantity of muco-purulent secretion, which soon becomes foetid and mixed with *debris* from the seat of disease. Hemorrhage also occurs ; either merely at times tinging the discharge more or less, or, if a considerable vessel has been ulcerated through, flowing in a continuous stream.

On examination in an early stage of the disease, the cervix uteri is found enlarged, hard, irregularly nodulated, more or less tender to the touch ; the os much increased in size, and more or less dilated. On inspection, the cervix is seen to be generally of an unhealthy red colour, and there may be excoriations in the sulci between the nodules ; the excoriations being of a deep red hue, and the nodules projecting and often showing very little redness.

In general, cancer of the uterus is of easy diagnosis ; patients usually presenting themselves after ulceration, with its accompanying discharges, has commenced, and infiltration into the cervix and surrounding tissues is considerably advanced. It is liable to be confounded with hypertrophy of the cervix, with fibrous tumour of the uterus, and with polypus ; and the grounds of distinction have already been given in treating of these subjects.

The disease is incurable ; and treatment is confined to palliation. Sometimes the excessive watery discharge may be moderated by the use of astringent lotions, or the application of astringent ointments ; especially those having tannin in their composition. If there is much tendency to hemorrhage, no local application can be used with safety. Bleeding, when it occurs, must be arrested in the usual way—by horizontal position, cold, styptics, astringents and opiates internally, and plugging if necessary. Fœtor in the discharges is corrected by use of the ordinary disinfectants and deodorants, employed as lotions and injections. The pains in the hypogastrium and loins may be relieved for a time by blistering, or by cupping ; no blood, or a small quantity being taken—according as there is much sharpness and frequency of pulse, or the reverse. The local application of ice, or of refrigerating mixtures, through the speculum, has sometimes been of service. But

for the pains of this, as of all other forms of cancer, the great remedy is *opium*.

When the disease is seen in an early stage, the cervix still mobile, and presenting only some prominent indurations—and if other circumstances, as the general health and age of the patient, are propitious—an attempt may be justifiable to remove the part by excision, or by strong caustics, used as already described in speaking of the inflammatory hypertrophy of the cervix, and of corroding ulcer. If this cannot be done, it is prudent to interfere with the parts as little as possible. If there is much cancerous growth and induration, any violence, such as even introduction of the speculum, is liable to do much harm, by tearing or bursting the lacerable structures and inducing hemorrhage.

CHAPTER LXV.

OPERATIONS ON THE BLOOD-VESSELS OF THE LOWER EXTREMITY.

The Aorta.

Compression of the Aorta may often be of service in cases of pelvic hemorrhage, amputation at the hip-joint, or amputation high in the thigh—assisting both Nature and the surgeon in their hemostatic means. And it can be readily effected by direct compression of the vessel against the vertebral column—a little above, and to the left side of the umbilicus—when obesity, abdominal tumour, or intestinal distention, do not interfere. Although the thumbs of an assistant, or a small volume wrapped in lint, may suffice for this purpose, when a sudden exigency occurs, an instrument specially constructed is better suited to maintain continuous and accurate compression of the vessel during the performance of an operation. For this purpose, the compressor of Carte, a large Signoroni's tourniquet—or, better still, a semicircle of steel like Hoey's clamp, as recommended by Professor Lister—will be found most serviceable. The compression may be continued for a considerable period without bad consequences. On two occasions, Mr. Syme has employed continuous compression by means of the clamp during the operation of laying open an aneurism of the external iliac, and applying ligatures to the arterial apertures of communication. When applied, however, very considerable pain is experienced, unless the patient is under chloroform.

Deligation of the Aorta is very seldom required of the surgeon. Spontaneous obstruction of the vessel, doubtless, has occurred in a few cases, without serious consequences ensuing. But this event is wholly different from the abrupt mechanical obstruction by ligature; and, besides, the ligature cannot be applied without the infliction of a most hazardous wound.

From the operation, a permanently successful result cannot be expected; it must, we fear, be regarded as inevitably fatal. But circumstances may occur, notwithstanding, to warrant its performance with the object of protracting existence for a few hours; saving the patient, perhaps, from death by the direct effect of hemorrhage, and affording an opportunity for the arrangement of momentous affairs; yet without any expectation of ultimate recovery. The vessel may be reached in one of two ways; directly, by incision through the abdomen, as in the cases operated on by Sir A. Cooper, and Mr. James of Exeter; or indirectly, on the outside of the peritoneum, by extension of such a wound as is suitable for deligation of the common iliac, as was executed by Murray (Cape of Good Hope), Monteiro (Rio Janeiro), and Mr. South. Were

there a chance of successful issue, the latter method, though the more difficult, should certainly be preferred. But, as it is, the direct mode is likely to be adopted, by any one who may find himself called upon to undertake so unpromising and serious a procedure. Before operating, if time and circumstances permit, the bowels should be opened by a warm purgative, so as to void both their gaseous and their solid contents. In performing the direct operation, a suitable incision is made to the left of the mesial line, commencing above the umbilicus, and terminating a little below it. Having reached the peritoneum by careful dissection, and opened up its cavity—using the probe-pointed bistoury, guarded by the finger, to dilate the wound—the intestines are carefully pushed aside, the peritoneum is again divided, or scratched through with the finger nail, the vessel is exposed, and a ligature applied.

Aneurism of the Abdominal Aorta itself is obviously remediable only by general treatment. In the nervous, hysterical, dyspeptic, and anemic, the affection is simulated by great abnormal pulsation in the course of the vessel. It is known by distinct perception of a tumour, which is not movable; by observing that the tumour pulsates equally in all directions; by pulsation and bruit being limited to this one part of the vessel, not diffused equally along its course; by the bruit being equally distinct in the supine and in the erect postures; and by the pulsation being constant, not occasional and intermittent. At the same time it is right to state, that the diagnosis of abdominal aneurism, especially in its incipient state, is often very obscure; solid tumours, in the neighbourhood of the artery, partaking of the aneurismal characters very closely.

The Iliacs.

On account of inguinal aneurism, and aneurism affecting the common femoral artery, or its branches close to their origin—also on account of hemorrhage not otherwise repressible—the *External Iliac* may require deligation. Due systemic preparation having been made, the patient is placed recumbent, with the abdominal parietes relaxed by position; and the surgeon proceeds to operate, with the intention of securing the vessel without injury of the peritoneum. Many forms of incision have been proposed and followed. These are, however, referable to two types; 1st, Mr. Abernethy's, parallel to the course of the vessel; and 2d, Sir A. Cooper's, parallel to Poupart's ligament. Lisfranc's modification of the latter is exact, and suitable; exposing the vessel readily enough; not calculated unnecessarily to weaken the abdominal parietes; and, at the same time, causing little risk to the spermatic cord and artery, or to the circumflex artery and vein. The knife is entered, two lines above, and an inch within, the anterior superior spinous process of the ilium; and, being carried downwards, nearly parallel to Poupart's ligament, the incision is terminated at an inch above the level of the spine of the pubes, and about an inch and one-third on its external aspect—i.e., a little above, and about an inch to the outside of the external inguinal ring. By cautious dissection, the tendon and fibres of the external oblique where exposed are cut through, and the fibres of the internal oblique

and transversalis are divided as near the anterior superior iliac spine and Poupart's ligament as possible, till the fatty texture, which always exists there, is seen shining through the transversalis fascia; the finger is then introduced beneath the remaining muscular fibres, and they are divided with a probe-pointed bistoury. The transversalis fascia is scratched through with the point of the knife—near its upper extremity, where inserted into the iliac spine and Poupart's ligament, as an areolar interval here separates the fascia from the peritoneum; and, the finger having been introduced through the aperture, on this the rest of the fascia is divided in safety. The bag of peritoneum, further separated from the fascia iliaca, is pushed to the inner side; and is held out of the way by the fingers of an assistant, or by means of a flat copper spatula, or by a hook made for the purpose. The inner border of the psoas muscle is traced with the finger; and the artery will be detected by its pulsation there. The vein is found on the inner side, and is cautiously separated by the finger nail, or by the point of the knife; the artery is then more fully isolated, by the same means; and the aneurism needle is passed from the inner side. The wound is managed in the ordinary way; by position of the trunk and limbs, abdominal relaxation is maintained; and the whole abdominal contents are supported, especially if the patient suffers from a cough, by means of a firmly-pinned binder.

This operation is, in general, easily performed; unless when great obesity is encountered; and is, perhaps, the most successful of its class. In aneurism, the point for securing the vessel must necessarily vary according to the bulk and site of the tumour.*

The Internal Iliac was first tied by Stevens of Vera Cruz in 1812, on account of gluteal aneurism in a negress. This vessel may require deligation on account of aneurism of its branches; and the operation has also been resorted to on account of hemorrhage from these. Bleeding from deep perineal wounds, for example, may possibly not otherwise be restrained. And in false aneurism of the gluteal or ischiatic arteries, this operation is by some considered preferable to direct incision of the tumour. The securing of the vessel is attended with about the same amount of difficulty and hazard as obtains in the case of the common iliac artery. The patient having been placed as before, an incision is begun over the middle of Poupart's ligament, and carried upwards, as in the line of the former incision, to the extent of three, four, or five inches; the extent varying according to the contemplated depth of the vessel, and always leaning rather to the side of unnecessary amplitude. The comparative length of the external wound, intrinsically, will have but little effect on the success of the operation; and yet it has a most important bearing on it, according as it facilitates, or impedes, the accomplishment of exposure and deligation. The abdominal muscular layers having been cut through, the transversalis fascia having been divided, and the peritoneum having been pushed aside, as previously directed,

* When aneurism involves the external iliac up to or beyond its origin, it has been suggested by Mr. Syme that the sac should be laid open extra-peritoneally, the aorta being meanwhile compressed, and the vessels tied where they enter the sac. In two examples he has carried this proposal into execution.

until the ureter is seen separated from the psoas muscle along with the peritoneum, the sacro-iliac articulation is felt ; and there within the brim of the pelvis the vessel will be found pulsating. The origin of the artery is nearly opposite the centre of a line, drawn from the anterior superior spinous process of the ilium to the umbilicus. Usually the external iliac—first found—proves the best guide to the internal. Isolation is effected by the finger-nail, and by the end of the aneurism needle. It is not necessary to use the knife here, as the areolar tissue surrounding the vessel is so loose. The wound being then fully opened by assistants, the needle is passed, from within outwards ; taking care to avoid the ureter and peritoneum internally, the internal iliac vein which lies posteriorly, and the external iliac vein which lies to the front and passes behind the origin of the artery. The point of deligation should be made at a suitable distance from the iliac bifurcation.

Ligature of the Common Iliac may be required for aneurism. It has also been resorted to on account of hemorrhage implicating the external and internal iliac arteries ; and is recommended by some for the arrest of secondary hemorrhage after high amputation in the thigh. The vessel is reached by an incision identical with that just described ; and the operation is, perhaps, as easy and promising as the preceding. The vein is found on the inner and pelvic aspect of the artery, on the left side ; on the right, it lies behind and then external to the artery, behind which the left common iliac vein also passes to its termination in the vena cava inferior.

A similar incision, extended upwards, may serve, as already stated, for deligation of the aorta.

The Femorals.

Aneurism of the Common Femoral, or of the Superficial Femoral, or of the Profunda, as formerly observed, requires deligation of the external iliac. False aneurism may form in the lower part of the superficial femoral ; and for this, the ordinary operation for such an accident is requisite ; namely, incision of the sac, and deligation of the artery above and below the wounded part. But, on account of the close cohesion which exists between the artery and vein, and the risk of injury to the latter by such an operation, in this situation, ligature on the cardiac side of the aneurism has been recommended in preference. In one case, where the aneurism was situated at the commencement of the adductor sheath, Mr. Syme tied the superficial femoral with success. Aneurismal varix, too, is occasionally met with here, of traumatic origin ; a penetrating wound having been inflicted by the grasping of a knife, or other sharp-pointed instrument, between the thighs. It may prove but little troublesome, and demand no other treatment than support of the part by bandaging.

The Popliteal is probably the most common of all external aneurisms ; and, hitherto, the Hunterian application of ligature to the superficial femoral has been the only approved mode of treatment. Latterly, however, as elsewhere explained, the application of pressure, instead of the ligature, has been employed ; and experience has given undoubted testimony to the efficacy of the practice. There are patients, doubtless, who may prove intolerant of pressure ; and there may be others who prefer the apparent

certainly of the knife and ligature, to the apparent uncertainty and delay of the compressor. But a large number of cases are assuredly capable of cure by pressure properly applied ; without risk, with but little pain or inconvenience, and without any wearisome amount of privation or confinement. The skin, which is to bear the pressure of the instrument, is protected by a layer of thick soap-plaster ; and that, again, may be covered by leather. More than one compressor is used ; so that the pressure is made at different parts, at different times ; and the burden of it is not all thrown on one point, but subdivided, and thus rendered more tolerable. Instead of the clamp, compress, and complicated apparatus, consisting of a combination of screws and caoutchouc straps, which were employed about ten years ago, leaden weights are now frequently used. These resemble a conical bullet in shape, each weighing on an average from five to ten lbs. ; and when confined in a stout leather case or socket attached to and over the thigh, they can have their dead weight so directed as to control the circulation through the femoral artery with more comfort to the patient than in any other manner. Using several such weights, along the course of the vessel in the thigh—they may be applied alternately ; or the same instrument may be shifted in its socket with a like effect. Best of all, however—most efficient, most exact, and most tolerable—is “animal pressure,” applied by the steady and intelligent fingers of assistants, in suitable relays. It is never to be forgotten, that all severity of pressure is unnecessary ; and that it is not our object completely to arrest the arterial flow at the compressed point. And it is also important to remember, that should this mode of treatment fail, it by no means interferes with subsequent performance of the ordinary operation ; but, on the contrary, the constitutional treatment suitable for pressure renders the success of subsequent deligation all the more probable. The only fear may be that the collateral circulation, if the compression fails after having been long continued, may have become so freely established as to render the subsequent application of the ligature insufficient.

More recently, direct compression of the popliteal tumour by flexion of the knee has been advocated by Mr. Hart and others. This may be employed either singly or in combination with compression of the femoral. The beneficial effect of this method of direct compression, as contrasted with the measures resorted to for a like purpose by the older surgeons, seems to be referrible—1st, To the natural textures being the medium by which the compression is exerted ; 2d, That the bending of the knee not only compresses the aneurism, but alters the course of the popliteal artery by increasing its curve, and thus proportionately diminishes the force with which the blood passes through it into the aneurismal sac. In effecting compression by flexion, a worsted stocking should be drawn upon the limb, a roller bandage having been first applied uniformly from the toes up to the knee. To the sole of the stocking, straps or bandages are attached, by which the heel can be gradually approximated to the buttock, by means of buckles upon a waist-belt firmly fixed round the loins. The management of this simple apparatus is entrusted to the patient, who is confined to bed, and directed to increase or diminish the traction on the heel according to his sensations. He should be fed on

a non-stimulating diet, and opiates should be administered at night to procure sleep, if required.

Recorded facts seem to prove the following conclusions with reference to compression, direct and indirect :—1, That, in popliteal aneurism, skilful compression of the femoral is often capable of curing the disease, and that with comparative and almost absolute safety to life and limb ; 2, That the time expended in cure is, on an average, not greater than in the treatment by ligature ; 3, That failure by compression has not hitherto been found to preclude success by subsequent recourse to deligation ; 4, And that consequently compression, when skilfully employed, being quite safe, and not more tedious than the ligature when it succeeds, should in the great majority of cases be fairly tried. The only disadvantage of compression is the care and trouble necessary on the part of the attendant, with irksomeness and sometimes very considerable suffering on the part of the patient. The obvious and great advantage of deligation, on the other hand, is the facility, simplicity, and economy of time in its execution, with probable exemption from suffering afterwards by the patient, in successful cases. The formidable disadvantage is, its proved risk to life and limb.*

When ligature of the superficial femoral is determined upon, the operation, as first practised by Mr. Hunter (1785), beneath the crossing of the sartorius, is rarely performed at the present day ; the method of Scarpa, *at* the crossing of the muscle, being preferred, on account of its greater facility and safety. The patient is placed recumbent, with the upper part of the thigh suitably exposed, by bending the knee and laying the limb upon a pillow on its outer side. Having shaved the hollow of the groin, if necessary, the surgeon feels for the pulsation of the vessel at the apex of Scarpa's triangle, where the upper margin of the sartorius crosses the adductor longus. This usually corresponds to a point about four inches below Poupart's ligament. Should the patient's thigh, however, be so thickly clothed with fatty texture as to render the pulsations feeble, and the hollow indistinct, he may be directed slightly to adduct and raise the thigh, so as to make the inner edge of the sartorius salient ; and towards this the femoral is traced, by an imaginary line, from the middle of Poupart's ligament. An incision of two or three inches in length is then made, in the course of the vessel ; so placed, that its centre may correspond to the point of crossing of the sartorius. The first incision should expose the fascia, and display the fibres of the sartorius passing downwards and inwards ; above this the fascia is opened to the full extent of the wound, and the muscle is drawn outwards by means of a blunt hook ; a little areolar tissue is then cut through, and the sheath is exposed and freely opened. The arterial coats are now cleared transversely, so as to recognise the outline of the vessel ; and in a longitudinal direction, only so far as to admit of a free passage to the needle. In the external wound, the anterior saphena vein is avoided ; in the deep dissection, avoidance of the femoral vein cannot too prominently occupy our regard. The needle is passed very cautiously, so as

* *Vide* Tufnell, *op. cit.* ; and Brit. and For. Med. Chir. Rev., Oct. 1851, p. 470. *Vide* also cases by the author, Edin. Med. and Surg. Journal, Jan. 1855, p. 33. Howden, Med. Chirurg. Transac., vol. xxi. p. 318.

to prevent all injury to the vein ; which is situated posteriorly, and may, if the vessel is tied high, be partly seen bulging out on the inner aspect of the artery. In passing the needle, material assistance will be obtained by holding the areolar tissue, which has been cleared from the arterial coats, stretched transversely by means of catch forceps. Should the vein be wounded, or partially included in the ligature, the obstruction of this vessel, along with the artery, is sure to determine the occurrence of gangrene. A small escape of blood, however, as the needle is being carried round the artery, does not necessarily imply that the vein has been injured, but only that a small nutrient vessel has been torn, perhaps ; and such hemorrhage always ceases when the ligature is tightened. The point usually chosen for deligation is where the vessel is crossed or concealed by the sartorius ; sufficiently removed from the profunda ; and not too near the aneurismal tumour.

In performing this operation, the surgeon should always make sure that the tightening of his ligature has a satisfactory effect on the tumour ; for there is the same risk of a high division here, as in the case of the humeral artery ; and, consequently, two parallel vessels may exist as in Sir C. Bell's well-known case. After deligation, a relaxed position of the limb is maintained, for obvious reasons.

In performing the operation beneath the crossing of the sartorius, the incision should commence over this muscle, and extend beyond its external lower border, and the same parts are cut through as in the higher operation ; the muscle requiring to be drawn inwards by means of a hook. The fascia will here be found much stronger than above ; and the long saphenous nerve will be seen to the outer side of the artery, which is here more abundantly supplied with an envelope of areolar tissue within its sheath.

In most cases, after ligature of the femoral, the collateral circulation becomes established with more difficulty than in the obliteration of other arterial trunks for aneurism. Hence, mortification is apt to ensue. In some few cases, however, such a very free circulation eventually occurs, that the symptoms of aneurism return so soon as pulsation in the tibials becomes distinct. In such cases, treatment by flexion, whether previously employed or not, should be had recourse to.

On account of secondary hemorrhage in thigh stumps, ligature of the superficial femoral was at one time frequently employed ; unnecessarily, however, as we know now that mere suppuration of a wound may constitute no obstacle to tying a vessel bleeding upon its surface.

For aneurism of the superficial femoral in its upper part, the *Common Femoral* may be tied. But this vessel is, for obvious anatomical reasons, not favourably circumstanced for successful deligation ; and, in consequence, the equally simple and greatly more certain operation, on the external iliac, is to be preferred. In recent wound of the common femoral, however, with or without the formation of false aneurism, the ordinary rules of surgery are to be upheld ; the part is cut directly into, and the vessel is secured above and below the wound. The femoral vein, here on the pubic side of the artery, is carefully avoided.

The Popliteal.

For aneurism, or for bleeding, in connection with the posterior tibial, the Popliteal artery may be tied ; but ligature of the superficial femoral, below where it is crossed by the sartorius, is a preferable operation. For wound of the popliteal itself, however, ligature of that vessel is necessary, according to the general principles of surgery. The patient having been secured in a prone posture, a free incision is made, traversing the popliteal space, and penetrating through the skin, areolar tissue, and fascia. The deep dissection is continued cautiously, along the borders of the semi-tendinosus and semi-membranosus muscles. On the edge of the latter muscle, the artery may be felt beating ; perhaps overlapped by it. The vein is superficial, and somewhat external to the artery. The nerve is both on a more superficial plane, and on the exterior of the mesial line. The vessel is most readily exposed and secured thus in the upper part of its course.

When it is necessary to tie the lower part of the popliteal otherwise than by an extension of an already existing incision, this may be effected in another way :—The limb having been laid on its outer side, with the knee flexed and laid on a pillow, an incision is made along the tibial aspect of the inner head of the gastrocnemius, commencing a little over the inner hamstring tendons, and extending downwards for four or five inches. The internal saphena vein should be avoided if possible ; and the fatty texture having been divided, the fascia is opened to the full extent of the external wound. The gastrocnemius is then turned outwards, and the fascia covering the popliteus muscle exposed. Following the lower border of this muscle and the origin of the inner head of the soleus, the termination of the popliteal artery will be reached, accompanied by the vein and posterior tibial nerve, closely bound together by the fibrous tissue passing between the heads of the soleus. The nerve and vein having been carefully cleared from the artery, its deligation is easily effected.

The Tibials.

These vessels may require ligature on account of recent wound, or for the cure of false aneurism formed at some part of their course. For secondary hemorrhage, ligature of the femoral is to be preferred ; if recourse to an operation of this kind should ever be deemed expedient. The posterior tibial and perineal have been tied on account of aneurism by anastomosis affecting the muscles of the deeper layer on the back of the leg.

Ligature of the *Posterior Tibial*, at the upper part of its course, is an operation of considerable difficulty. Two methods are recommended—one consisting of a direct incision on the vessel, through the centre of the gastrocnemius and soleus ; the other reaching the vessel from the lateral aspect. The latter is usually preferred, except in the case of a wound already existing. The limb having been placed on its outer side, a free incision is made parallel to the edge of the tibia, and over the inner head of the gastrocnemius ; the fascia is then divided at the margin of this muscle—the cutaneous wound being displaced inwards for this

purpose—turning the inner belly of the gastrocnemius outwards ; the soleus is then cut through in the line of the original incision ; and in doing this the existence of its tendon on its under surface must be borne in mind. The deep fascia is now exposed and divided ; and the artery will be found about an inch from the tibia, between the concomitant veins, and with the nerve on its fibular side. Separation of the veins is made very carefully, while the edges of this deep wound are as much retracted as possible by means of copper spatulæ ; the knee being bent, and the foot extended, so as to relax the muscles of the calf. The needle is passed from without inwards. In the middle of the leg, a similar operation requires to be performed, as the soleus still takes origin from the tibia ; the line of incision should, however, be nearer the tibial margin than in the former case ; about two fingers' breadth being a suitable distance.

At the lower part of the leg, the vessel is reached much more readily ; by making an incision midway between the tibial margin and the tendo Achillis. Two layers of fascia require division, when the nerve will be recognised ; and by a little dissection to its tibial side, the artery will be exposed, with its concomitant veins. Separating the vessel from these, the ligature is applied in the ordinary way.

At the ankle, the operation is also simple. A semilunar incision is made behind the malleolus, midway between it and the tendo Achillis ; or the finger, applied behind the malleolus, may be a sufficient guide to the line of wound. The areolar tissue having been divided, a strong aponeurosis is exposed ; this having been cautiously cut through, the vessels are found ; and, the artery having been separated from its concomitant veins, the needle is passed in any direction that is most convenient—as the nerve is generally quite out of the way, being situated between the artery and the tendo Achillis.

The Anterior Tibial, in the first part of its course, is on the posterior aspect of the inter-osseous membrane, and cannot, of course, be reached from the front of the leg. After passing through the inter-osseous ligament, which it does about a hand's breadth beneath the tuberosity of the tibia, it may be tied in any part of its track, which is indicated by a line from the head of the fibula, to the outer side of the tendon of the tibialis anticus, or interspace between the great and second toe. The operation, when high, is difficult. In operating, a free incision is made between the extensor communis digitorum and tibialis anticus ; and it is well to make a transverse division of the investing fascia, at each extremity of the wound, as this enables the muscles to be more easily separated and held aside. The foot should now be flexed ; and following the nervous, venous, and arterial radicles which spread on either side down to the inter-osseous ligament, the artery will be found, with the nerve to the outer side. In the middle of the leg, the artery is placed between the tibialis anticus and the extensor proprius pollicis, with the nerve in front, lying upon the artery.

At the lowest part of the leg, a less incision is necessary ; the vessel being much more superficial. The wound is made on the fibular side of the tendon of the extensor proprius pollicis. The venæ comites, and the anterior tibial nerve, which now lies to the inner side, are carefully separated before passing the ligature.

Should it seem necessary to secure the vessel on the instep, by regular dissection, it is found by an incision on the fibular side of the tendon of the extensor proprius pollicis, in the line of the inter-osseous space.

The *Peroneal Artery* may be exposed, by a free incision on the posterior and tibial aspect of the fibula. It is found concealed beneath the inner edge of the flexor longus pollicis, under cover of the inner margin of the fibula.

Deligation of the arteries of the leg, however, being seldom if ever required, except on account of recent wound, all rules for regular dissection may be in a great measure dispensed with ; the extent and form of incision depending very much on those of the wound already existing, and the bleeding point being the best guide to the injured vessel ; avoiding, however, in all cases, as far as possible, all unnecessary transverse division of muscular fibre and tendons.

In bleeding from the foot, as in the hand, compression will generally be found quite efficient, and preferable, except in the case of an open wound, to cutting through important parts with a view to the application of ligature. In amputation of the great toe and its metatarsal bone, much difficulty is frequently experienced by copious hemorrhage taking place from the divided communicating artery, which passes from the dorsal artery of the foot to join the plantar arch. If the vessel is not at once secured by ligature, a pad of lint should be placed in the angle between the second metatarsal bone and the internal cuneiform, and supported in its place by a bandage.

CHAPTER LXVI.

AFFECTIONS OF THE JOINTS OF THE LOWER EXTREMITY.

Morbus Coxarius.

THE hip-joint is liable to the common diseases of articulations ; but, from its position, the exciting causes of synovitis affect it but little, comparatively. It is a common seat of chronic rheumatic arthritis, attended with porcellanous formation, interstitial absorption, adventitious product, and other chronic structural changes. It is sometimes affected by neuralgia, also ; and then is constituted the true *Coxalgia*—a term which, like its analogue *Omalgia*, has been improperly applied to structural change. But the most important as well as the most common affection to which this joint is liable, is chronic disorganization of the acetabulum and head of the femur ; to which the term *Morbus Coxarius* is applied.

There is reason to believe that the morbid changes usually observe the following sequence. An ostitic change takes place in the cancellated tissue of the acetabulum and of the head and neck of the femur. This may be of a tubercular, or inflammatory kind. After a time, a chronic inflammatory process is kindled ; and suppuration and disintegration ensue, affecting chiefly that part which is immediately beneath the articulating cartilage. The cartilage is then involved ; partly by ulcerative erosion, partly by necrosis of patches. Matter is effused into the synovial capsule ; and acute disintegration of the articulation is established. The cartilage perishes more and more ; the head of the bone crumbles down ; the joint fills with pus, and is converted into the condition of abscess ; the matter makes its way, more or less rapidly, and at one or more points, through the restraining textures ; corresponding pointing takes place, followed by evacuation ; and then either the work of disintegration may advance with a fresh and fatal energy, or a lull may be experienced, and ankylosis may ensue. Such we believe to be the ordinary course. By some the disease is supposed to commence rather in the head of the femur than in the acetabulum.

A more rapid and acute destruction of the joint may follow the inflammatory process primarily affecting the synovial apparatus. But the term *morbus coxarius* is, in strict accuracy, limited to the chronic and gradually nascent affection, which commences in the hard textures.

The disease is conveniently divided into two stages. The first, the period which is occupied in the incipient change of structure ; without such loss of substance as to cause change of form, and with the synovial capsule yet entire ; denoted by apparent elongation of the limb. The second, corresponding to loss of substance, change of form, and de-

struction of the joint ; indicated by the limb's shortening and distortion. By some, however, the symptomatic indications of the disease are presumed to be related to three stages. The first stage corresponding to commencing ostitic change ; the second, to the inflammatory accession ; while, in the third, the suppurative result and destruction of the articulation are included. The affection is most common in the young, more especially between the age of seven and the period of puberty, and in those of strumous habit. It may, or may not, be connected with some external injury as its exciting cause.

The primary symptoms are deceptive. They are such as may attend on dentition in childhood, or on general disorder of health in adolescence ; they may simulate rheumatism also ; and they are every day mistaken for primary affection of the knee. Obscure pains are felt in the knee and thigh, and occasionally in the hip. The limb is weak, and its weakness is complained of—increasing with exercise ; it is felt to be long as well as weak ; it is dragged, rather than moved, in walking ; in standing it is somewhat advanced, while but little weight is borne on it ; and all these symptoms are most observable during fatigue consequent on exercise. An inspection, with the body naked from the waist, is essential. The knee, in which for some time great and almost constant pain has been complained of, may be quite of a normal appearance, and also tolerant of manipulation. The affected limb is decidedly thinner, softer, and more shrunk in appearance than the sound one, and somewhat advanced in position ; the patient resting on the toes and ball of the foot, with the heel raised from the ground, and the whole limb rotated outwards. To bring the two heels together requires an effort, with suitable inclination of the pelvis ; and the effort usually causes aggravation of uneasiness. As in the analogous affection of the humerus the shoulder is flattened by wasting of the deltoid, so here is found a flattening of the hip by wasting of the glutei. The fold between the nates and thigh—deep and almost transverse in the normal state—is sloping, superficial, and sometimes almost effaced. Place the patient recumbent ; straighten the spine, equalizing the position of the pelvis as much as possible—and elongation of the limb will be observed ; the knees and heels by no means corresponding to each other. This elongation is only apparent, and is due to twisting of the spine and pelvis, so as to relax as much as possible the psoas and iliacus muscles, which tend to bear the articular surfaces against each other ; as can easily be proved by measuring the sound and affected limbs, between two such fixed points as the anterior superior iliac spine, and the external malleolus.

The foregoing symptoms, however, may almost all be found in the delicate adolescent, without disease of the hip. And a further examination is necessary for diagnosis ; by jarring the joint suspected. Forcible abduction of the thigh causes pain in the hip ; so does rotation inwards of the limb ; and a still more distinct sensation follows concussion, applied either directly or indirectly—by striking the knee, or the sole of the foot, or the trochanter-major, smartly. There is also tenderness of the groin, and behind the trochanter.

Thus far—the first stage—the disease is capable of complete cure ; the limb being left of its normal length, and restored to its normal form

and capabilities. But, too frequently, the morbid process advances. Pain and tenderness increase ; the hip becomes swollen ; and the thigh is increasingly flexed on the pelvis. A bulging is observable behind the trochanter ; and this bone seems displaced somewhat backwards. Enlargement also may form over the groin ; and the swellings may be felt to fluctuate. Opening and evacuation ultimately take place ; with one of the two results already stated.

In this, the second stage, shortening of the limb is observed ; the toes resting on the ground, without any advancement of the limb. As the shortening increases, the toes may not reach the ground at all ; but, turning inwards, may dangle over the opposite member, as in dislocation. Or the toes may be everted, as in fracture of the neck of the thigh bone. And it is supposed that comparative destruction of the acetabulum tends to inversion, while comparative destruction of the head of the bone favours eversion of the foot—a matter of some importance, were such symptoms infallible, in deciding upon the propriety of excision of the head of the femur in advanced cases of the disease. This actual shortening of the limb is plainly symptomatic of organic change in the joint ; disorganization of hard tissues as well as soft, destruction of the upper and posterior lip of the acetabulum, and abridgment of the head of the femur. And towards such shortening, no doubt, a spastic action of the muscles of the hip contributes materially, by forcing the affected bones, softened and spongy in their texture, against each other, until the remains of the head of the femur pass clear of the acetabulum. The hip appears more and more broad and prominent ; though really flat and wasted ; apparent enlargement depending on atrophy of the rest of the limb, with twisting of the pelvis. As disorganization advances within, the joint becomes more and more loose ; and dislocation may occur, by muscular action alone—without the intervention of a fall or other injury. The dislocation is usually upwards, on the dorsum of the ilium ; and this event is of course followed by increase of shortening in the limb, and by a still greater and more marked deformity of the hip. Matter, in general, continues to form ; and is evacuated at various points ; at the groin, behind the trochanter, in the thigh. Not unfrequently, perforation of the acetabulum takes place ; and then the matter may accumulate within the pelvis, fatally ; or it may again make its way outwards, through the sciatic notch, and discharge itself at some part of the hip or thigh ; or evacuation may take place by the rectum. Structural change may advance from bad to worse ; the patient perishing of hectic. Or ankylosis may take place ; the patient recovering with a stiff joint, and a shrunk and deformed limb. In the case of dislocation—by no means of frequent occurrence—it sometimes happens that disease ceases, and the head of the bone acquires a new recipient cavity on the dorsum of the ilium. More frequently, however, the head of the bone seems to act as a foreign body in its new site, and causes much inflammatory excitement.

Acute affection of the synovial apparatus in the hip—by some termed the Acute form of Morbus Coxarius—shews the ordinary characters of synovial disease. There is rapid and uniform swelling of the part, with acute pain in the hip, thigh, and knee, much increased by movement and pressure ; the thigh is bent upward, by spastic action of the muscles ;

and, very often, an apparent shortening of the limb is to be observed, dependent on twisting of the pelvis ; acute fever attends ; walking and even the erect posture are impracticable ; often the slightest movement, even during recumbency, is attended with great agony. If the disease be not speedily arrested, suppuration takes place ; the matter is discharged, by one or more openings ; and extreme articular disorganization too frequently results, with corresponding disorder of the system. Such a case is met by the ordinary treatment adapted to acute synovitis. Not unfrequently, the affection is partly of rheumatic origin.

The chronic disease, or true morbus coxarius, is also amenable to the general rules of practice. But, as already stated, it is only in the first stage that complete cure and restoration to health can be hoped for. The disease cannot be opposed too soon ; consequently, tact and experience are of much value, in enabling the practitioner to detect with certainty the obscure and insidious commencement. The paramount indication is rest ; one, however, which it is often very difficult to maintain effectively. The patient must be wholly confined to the recumbent posture. Neither the weight of the body nor motion of the limb must for an instant be permitted to act on the affected joint ; and the best way of accomplishing this, is to put the patient to bed, and keep him there ; the parents and attendants having been previously enlisted in the cause, by having the importance of the privation fully explained to them. The best means of securing complete repose is to apply the long splint, exactly as for fracture of the thigh bone. Indeed, the wearing of this splint may be recommended throughout the whole period of cure ; in order not only to oppose—gently and cautiously, at first—the decided tendency to flexion of the thigh which invariably exists—increasing along with the advance of disease—but, with the view of keeping the muscles around the articulation as thoroughly at rest as possible, lest by spasmodic twitching they aggravate the sufferings of the patient and tend to hurry on the destructive change. To facilitate the application of the splint, the patient should be put deeply under chloroform, while the limb is completely extended by the employment of gentle coercion.

At first, a few leeches may be advantageously applied over the hip—perhaps with repetition, should heat or pain seem to require this ; and then moderate counter-irritation is maintained, by inunction of croton oil, or tartar emetic.* If the tubercular cachexy be suspected, the suitable opposing constitutional management is put in force—especially cod-liver oil. And by steady perseverance in such treatment, for some months, all symptoms of disease may subside ; the patient may then dispense with the splint, and after confinement to the sofa during a period of probation he may safely rise, without any feeling of local ailment ; and, cautiously renewing the use of the limb, he may find, in due time, all its functions fully restored. But if the disease threaten to advance, and the pain prove specially violent at night, the actual cautery should be applied behind the trochanter ; unless, indeed, this be contra-indicated by the signs of acutely-developed scrofula.

* Part of the remedial action of these counter-irritants—and no slight part—is to increase the security of *rest* to the limb, by rendering all motion externally painful.

When the second stage is thoroughly attained, all severity of treatment is inexpedient; there being then no longer any hope of saving structure. When matter has formed, and is plainly discernible, seeking the surface, an early opening is advisable—here as elsewhere; an aperture must form sooner or later, and early evacuation may not only give relief, but may also limit the size of the abscess. Then we may hope only for a minor result of treatment—anchylosis; or for gradual cessation of disease, leaving the joint crank, weak, yet movable, and a limb impaired in both its symmetry and function. To conduce towards such ends, we mainly trust to general treatment; keeping the parts steady by means of splints.

Even at this advanced stage, if possible, it will be found advantageous to straighten the limb. No violence, however, is justifiable; and chloroform is administered simply with the view of affording complete muscular relaxation, which the timidity of the patient would be sure unintentionally and unconsciously to resist. When the straight posture can be effected, it should be maintained—by means of the long wooden splint; by which simple application the increasing deformation of the joint is prevented, and while the spontaneous arrest of the disease is favoured, the position is the most favourable for usefulness after anchylosis. In open disorganization of the joint, the straight splint, however, may not be tolerated; and then relief is obtained from the gutta percha or leather splints, or from the use of the starch bandage suitably applied, as in the advanced affections of other joints.

When from synovitis, imperfectly resolved, stiffness of the hip remains, orthopædic treatment may be applied with advantage; friction, passive motion, and perhaps subcutaneous section of resisting muscles. But in the case of anchylosis following structural change in the joint, the result of true morbus coxarius, all such attempts will be wisely desisted from; we ought rather to content ourselves with possession of a partial cure, than incur the risk of return of the disease in an aggravated form.

There are cases, however, in which the propriety of resection may be not unreasonably entertained; when, in an open state of the joint, after spontaneous dislocation, the head of the bone seems to cause much excitement in its new site; when there is good reason to suppose that the disease has all along been chiefly limited to the head of the bone, leaving the acetabulum comparatively uninjured; and when it seems probable that, after removal of the head of the femur, quiet might be restored to the joint, and a certain degree of useful motion might be regained. Successful cases are already on the records of surgery.*

The diagnosis of morbus coxarius from other diseases is important. It is simulated by sciatica, by enlargement of bursæ, by disease of the lumbar vertebræ or of the sacro-iliac synchondrosis, by rheumatism, by interstitial absorption of the neck of the thigh-bone in the aged, and by wasting of the limb consequent on general irritation in the young. 1. Sciatica is known by the pain following the course of the sciatic nerves; the whole thigh and leg is lame; position of the trochanter, and the length of the limb, are unchanged. 2. Beneath the conjoint tendon of the psoas

* *Vide* Lancet, No. 1285, p. 414. In the same Journal, the question of resection, as applicable to this joint, will be found well stated, No. 1283, p. 362.

magnus and iliacus internus muscles, a bursa is interposed, where the tendon plays on the capsule of the hip-joint. And this bursa is liable to chronic enlargement ; causing pain in the hip and knee, flexion of the thigh, disuse and wasting of the member. The enlargement may be felt, and is painful on pressure ; succussion of the joint itself causes no pain ; abduction and rotation of the limb are not attended with inconvenience ; but forcible extension of the thigh and inversion of the foot cause pain, by stretching the affected part ; and pain is also felt when the patient himself flexes the thigh, or everts the foot—the tendon then acting directly on the bursal swelling. Similar bursal enlargement may occur posteriorly beneath the gluteal mass. 3. Disease of the lumbar vertebræ and sacro-iliac synchondrosis, inducing neuralgic pains in the hip and limb, and impeding progression, is suspected when there is absence of the positive signs of hip-joint disease, as well as of those of bursal affection ; and the existence of either may be ascertained by minute inquiry into the history of the case, with careful manipulation of the lumbar and sacral regions, while the hip-joint will be found altogether free from either tenderness or stiffness if only the pelvic joints are kept steady. 4. Young girls, about the time of puberty, or earlier, are apt to fall into a state of general disorder of system. Among other signs of this, lameness of one limb may occur, perhaps with occasional pain of the knee ; and, on examination, the limb may be found smaller than its fellow, the muscles soft and flabby, and the hip, consequently, somewhat flattened. Abduction, rotation, and succussion, however, are all well borne ; and on the affected limb the patient may hop round the room, with impunity. It were cruel, as well as futile, to confine that patient to constant recumbency, to leech the hip, or to bring out crops of pustules over it. It is sufficient to enjoin moderate exercise, sea-bathing, friction, and general tonic treatment. 5. The other affections mentioned, as liable to simulate hip-joint disease, are detected by ordinary care in diagnosis ; they require no special remarks.

Resection of the Hip-joint.

Till lately, as suited to cases of disease, this operation has not had a place in surgery ; for long, however, the removal of the head and neck of the femur had been recommended, as suitable in cases of gunshot fractures of the neck of the thigh-bone, implicating the hip-joint, where, otherwise, amputation would be necessary. Still, though it has frequently been performed, excision of the head and neck of the femur, with scooping out of the acetabulum, cannot be by any means considered as occupying the same position as excision of the head of the humerus, of the elbow, of the knee, or even of the wrist-joint ; the grave objection to such a procedure always being, the difficulty of so thoroughly removing the diseased osseous textures as in the other joints. As just stated, in a few cases of advanced morbus coxarius it may be deemed warrantable ; when the head of the femur is dislocated, and is causing continuance or aggravation of excitement ; when the joint is open ; when the muscles are wasted, and the head of the bone, consequently, is covered with little else than skin and areolar tissue ; and

when there is reason to believe that the acetabulum is comparatively free from disease ; or, again, when the probe introduced through the sinuses comes into distinct contact with diseased bone ; and especially when this is recognised as lying loose in the cavity of the acetabulum, yet so shut in as to be incapable of spontaneously escaping. In one such case I removed the remains of the head and neck of the femur to reach the exfoliation, which I found to consist of a portion of the osseous tissue of the acetabulum. In connection, however, with this last point, it is well to remember that, after dislocation, the acetabulum may take on a healing action, and, instead of remaining ulcerated, may become occupied by a fibrous tissue. There can be no doubt that in gunshot wounds and other similar injuries, involving the head and neck of the femur only, removal of these parts is preferable to amputation of the whole limb ; and may be had recourse to unhesitatingly, with a good prospect of success. No decided rules can be laid down to guide the manipulations. The form and extent of the wound will depend, very much, on the nature of the openings which already exist. A straight incision should be preferred if sufficient ; but an extension backwards at right angles will perhaps be found necessary. This should be made upon the level of the trochanter. A sufficiency of the diseased or injured bone must always be removed, and the trochanter major and minor should generally be included in the excised parts ; as, in so doing, the muscles inserted into those parts must be divided, and thus the drain afforded for pus is rendered much more free and direct. After the operation, treatment consists in keeping the limb in the straight position, by means of a long splint specially constructed for the purpose, with a large aperture corresponding to the wound ; the continuity of the splint being maintained by a stout metallic hoop attached above and below to the two portions into which the splint is divided. The limb is placed straight, and retained in that position.

In the case of an ankylosed hip, the neck of the bone may be divided ; with the view of forming a false articulation at the sawn part, and so restoring motion. Success has already attended the experiment. Its reputation for safety and expediency, however, is as yet by no means determined ; while the necessity for its performance is more than doubtful ; as in all such cases the required mobility of the pelvic articulations admits, within a very short time, of a degree of freedom and ease in walking, which no operation diminishing the solidity and length of the limb could ever afford (p. 368).

Chronic Rheumatic Arthritis of the Hip-joint.

The chronic changes of form which frequently occur in the hip-joint, have been formerly treated of. By osseous product, and porcellaneous change—but especially by interstitial absorption of the head and neck of the femur, stalactitic formation around the head of the bone, formation of osseous ridges on the margin of the acetabulum, diminution of the depth of this, and flattening of the head of the femur, with thickening of the capsule, and formation of osseous nodules in its substance—most serious lameness occurs ; slowly, but steadily advancing, under

the cover of symptoms characteristic of chronic rheumatism in the part. The importance of the disease to the practitioner consists in its liability to occur after bruise of the hip and trochanter in elderly patients ; and in the danger of the subsequent deformity being attributed to a fracture of the neck of the thigh-bone, which, it is supposed, he has overlooked or maltreated. On dissection the changes sometimes very closely simulate those of fracture on the thigh-bone, within the capsule. The symptoms are—pain extending to the knee, becoming worse at night and increased upon motion, stiffness of the joint, shortening of the limb, and eversion of the foot. Rest and gentle counter-irritation may be required at first, with the continued use of the hot salt-water douche bath. The actual cautery does not generally afford satisfactory results. Constitutional alteratives—especially the iodide of potassium, and colchicum with quinine and opium—will be found serviceable in the early stage. Mercurials are for the most part contra-indicated. The diet should be strictly conformable to that suited to a gouty or rheumatic habit, while stimulants of all kinds are injurious. In the advanced stage remedies are of little avail ; except indeed the warm bathing, which, with friction and regulated exercise, should be diligently persevered in. Suppuration never occurs in these cases.

Affections of the Knee and Ham.

Affections of the knee are not so peculiar as to require separate consideration. This joint, it will be remembered, is especially subject to synovitis, acute and chronic ; to degeneration of the synovial membrane and to disease of the bone, with involvement of the cartilages ; and to the formation of loose bodies within the synovial cavity. It is not so suitable for the operation of Resection as the elbow or shoulder joints ; the only useful result being an anchylosed limb, to obtain which requires a very long-continued confinement of the patient to bed. The only cases in which, from observation, we should be inclined to recommend the operation are—1. Cases of injury in which an operation is performed either primarily for compound dislocation, or secondarily for fracture through the condyles with very great deformity ; or when suppuration has taken place in consequence of wound, and the alternative is excision or amputation ; 2. Cases of disease commencing in the articulating ends of the bones, not of a scrofulous kind, yet terminating in suppuration. There are, again, cases of disease commencing in chronic thickening of the synovial membrane, yet advancing to great involvement of the hard textures, but where the patient is of a healthy constitution and not as yet exhausted—except by pain—when the choice of the patient in favour of excision should be acceded to. In scrofulous cases, especially when occurring in children or adolescents who have not attained their full height, excision should be unhesitatingly rejected ; because exhaustion is very apt to occur from the long confinement to bed, and also because the principal points of growth in length, of both femur and tibia, having been removed by the operation, such a development of the limb cannot be expected as will make it correspond to its healthy fellow.

The operation may be practised, either by an H incision, or by elevat-

ing a large and wide semilunar flap, including the patella, on the front of the articulation. The patella in the former mode of incision is removed, in the latter it is retained ; the crucial ligaments are then divided, and the condyles of the femur are cleared and cut away above the level of the central notch, by means of a saw with a movable back. The knife is now carried cautiously behind the head of the tibia, and a moderate slice of its articulating surface removed. The bleeding articular vessels having been tied, the incision is brought into accurate apposition, with the ends of the bone placed in contact ; a padded splint is applied behind ; and a fracture-box, or a long splint, or sand-bags, or two side splints wrapped in a sheet and folded so as to come into firm contact with the inner and outer sides of the whole length of the limb, should be also adjusted. In the use of any of these, the apparatus must be so managed and contrived as to facilitate the dressing of the limb. The principal deformity which requires to be overcome is a tendency to rotation outwards, and eversion of the femur. The process of consolidation is always tardy, occupying months, and often taxing the patience of both surgeon and patient. In carefully chosen cases, however, the results are often most encouraging, and quite repay any trouble or suffering which may have made the daily progress of the case trying to both parties concerned.

‡ If the patella is found greatly diseased, its articulating surface and softened tissues should always be removed freely by means of a gouge.

Housemaid's Knee—that is, enlargement of the bursa over the patella—is extremely common in housemaids, shop-keepers, and others who habitually exert much pressure on this part. The affection is usually chronic ; sometimes, however, the case is acute, and apt then to be associated with an inflammatory process, not only within but external to the bursal sac, diffused along the surrounding areolar tissue. The ordinary treatment is required.

Abscess of the Ham is by no means unfrequent ; and may be connected with exfoliation from the posterior part of the femur. Such abscess usually points at the inner side, through the vastus-internus. When the portion of dead bone is large, considerable difficulty may be experienced in effecting its removal ; and free incision may be necessary. In some cases where the disease is of long standing, the division of the new bone to reach the sequestrum may be a most tedious and arduous operation. It is well, in all cases of necrosis of the lower part of the femur, especially when the knee-joint has already begun to sympathize with the morbid changes going on in the neighbouring parts, to make quite certain that the dead portion of bone is loose, before commencing any operation that involves cutting into the bone ; for while success is likely to allay all further irritation, an ineffectual effort at the removal has frequently determined acute suppuration within the articulation. In all cases, caution is obviously required, lest injury be done to the artery, vein, or nerve.

Ganglionic and bursal enlargements form in the ham, producing more or less inconvenience ; and these may be mistaken for aneurism. They are treated by repeated puncture by means of a trocar and canula, or by puncture followed by injection as in hydrocele, or by blistering applied over the surface as in the case of superficial cysts.

CHAPTER LXVII.

INJURIES OF THE LOWER EXTREMITIES.

FRACTURES.

Fractures of the Pelvis.

THE bones of the pelvis give way only under great and crushing force ; a heavy weight, for example, passing over or falling on the part. There is but little apparent displacement, so that the precise extent of injury can seldom be made out except an opportunity for dissection of the parts occur. The great risk is from injury done to the important parts within. The bladder may be torn, or it may be punctured by a spiculum, as formerly noticed ; a portion of bowel may be ruptured ; the anterior branches of the sacral plexus may be torn, or stretched injuriously, over the displaced surface of the sacro-iliac synchondrosis ; or great extravasation of blood may occur. From such lesions of structure, immediate danger to life results. A risk somewhat more remote follows mere bruise of the interior ; the inflammatory process being lighted up within, and advancing both rapidly and untowardly. Or instead of union, abscess may form at the site of fracture.

1. A waggon-wheel, rolling over the pelvis, may detach *the Crest of the Ilium* from the body of the bone. The upper fragment is displaced inwards ; and replacement may be effected by the fingers, ere swelling has occurred. *The anterior superior iliac spine* may be detached by direct violence ; the displacement is usually inwards and downwards. 2. From a heavy and high fall, fracture of the *Sacrum* may result. The fracture, when longitudinal, is not accompanied by displacement ; when, however, it is transverse or oblique, the coccygeal fragment is moved inwards. 3. A kick or fall may cause fracture of the *Coccyx*, and there may be considerable displacement inwards ; fracture may also be occasioned by passage of the foetal head from the pelvic outlet. By means of the finger in the rectum, accurate readjustment may be effected ; and it is very obvious that, in the after treatment, both purgation and constipation are to be avoided. 4. The *Os Pubis* may give way in its horizontal, or in its descending ramus. These two fractures either occur together, or the former is complicated by a solution of continuity in the ascending ramus of the ischium. 5. The ascending ramus of the *Ischium* is as frequently broken as any other part of the pelvis. In the two last mentioned injuries, the line of fracture may involve the pubes and ischium on both sides ; or the sacro-iliac synchondrosis upon the opposite side, or even upon both

sides, may give way by complete rupture, or by partial yielding. These fractures are especially hazardous, from the risk which displacement of the sharp fragments inwards entails upon the bladder. Sometimes the fragments at the seat of the fracture are driven through the perineum, or into the rectum. The *tuberosity* of the ischium may be separately detached. Crepitus is readily felt by the finger in the rectum or vagina; and by the same means readjustment of the fractured portions is to be effected. 6. The *Acetabulum* may be split; the accident is usually the result of violence acting directly upon the trochanter major; and intra-capsular fracture of the neck of the femur may be simulated. There may be no shortening of the limb; but if the head of the bone has been forced into the pelvis, the shortening may vary from half an inch to an inch and a half. The limb may be either everted or inverted, according to the direction of the violence, and the mode in which impaction has taken place. Crepitus is felt by the finger in the rectum or vagina—when the pelvis is moved, not during mere rotation of the thigh.

In treatment, little is to be done in the way of replacement; the chief care must be directed towards avoidance of motion, and the averting of inflammatory accession. The application of a broad firm bandage suffices in most cases to fulfil the former indication; in some, however, the long splint should be applied—not to effect extension, but merely to ensure repose. The latter indication is fulfilled in the ordinary way. In all such cases, the catheter should be passed at once; to determine, by the presence of urine in the bladder, and by ascertaining whether it is clear or tinged with blood, whether any injury has been sustained by the vesical coats.

Fractures of the Femur.

I. *Fracture of the Neck, within the Capsule.*—This accident is almost peculiar to advanced years; and occurs more frequently in women than in men. The external dense portion of the bone is atrophied, a mere thin shell enclosing the cancellous texture; the neck tends to become rectangular, instead of being oblique, in relation to the shaft of the bone; and there is, besides, the brittleness of the osseous texture peculiar to old age. The accident may be produced by direct violence, as by falls on the hip; more frequently it is the result of indirect violence, as by slip or stumble, of comparatively trivial amount. The upper fragment remains *in situ*; the lower fragment is drawn upwards by the muscles of the hip, and rests above and on the brim of the acetabulum—further elevation being resisted by the capsular ligament. Such displacement may not occur immediately, however; not until spastic action of the muscles takes place—perhaps, some hours after receipt of the injury; and if the periosteal investment be not wholly torn through, the displacement after all may be but slight. When shortening, to a marked extent, occurs suddenly after some hours, there is reason to infer that the periosteal investment, at first but partially torn, has then given way entirely. By muscular action, also, the lower fragment is everted; the muscles inserted into the trochanteric fossa, inter-trochanteric line, and trochanter minor, especially conducing to this change.

On examination—best conducted with the patient laid straight on his back—the following signs of the injury are observable :—There is always, ultimately, shortening of the limb, which may vary from half an inch to nearly two inches ; but immediately after the receipt of the accident there may be no appreciable shortening whatever, as just explained. The toes are everted, and the eversion can be undone by the surgeon, though not without the infliction of much pain. Like the shortening, the eversion may at first be but slight. In such cases impaction probably occurs, while the periosteal covering of the neck of the bone remains either in whole or in part untorn. The trochanter is higher and flatter than its fellow. Voluntary motion and power are greatly abridged ; forced motion is preternaturally extensive. On rotation of the limb, the hand placed over the trochanter, or on the groin, will usually perceive distinct crepitus ; but only when extension has previously been made, so as to bring the fragments into apposition. The neck of the femur may, however, be fractured within the capsule, and no crepitus be distinguishable. In difficult cases, crepitus may usually be obtained by flexing the thigh completely upon the abdomen, and effecting rotation and circumduction of the shaft of the bone. Such a procedure, however, is not to be unnecessarily resorted to ; being liable to lacerate the untorn periosteal tissues, which may still surround the neck of the bone. By gentle extension, the shortening may be undone, and the two heels brought together ; but on ceasing to extend, muscular action soon restores the shortening as before, or may, by disengaging the broken surfaces from contact or impaction, suddenly render it much greater than at first. On rotating both thighs, the trochanters will be found “moving in the arcs of different circles ; that on the injured side rolling on its own axis, while the healthy trochanter describes an arc of which the neck forms the radius.” There is no great amount of swelling ; as can readily be understood, when the nature of the injured parts is considered.

It is possible that impaction may take place—the lower fragment being driven into the upper ; in which case, shortening and eversion will be slight, and crepitus will be absent unless impaction be undone by extension. When inversion of the limb has been observed in cases of fracture of the neck of the femur, some have asserted that from this symptom alone the extra-capsular nature of the fracture might be diagnosed. Inversion does, however, sometimes occur in intra-capsular fracture ; and the only peculiarity observable in the dissection of these cases has been that the inferior fragment lay in front of the superior.

Union of this fracture is quite possible, but very improbable—especially when the bones are not impacted. The following are the more important obstacles to such an occurrence :—1. There is an obvious difficulty in maintaining accurate apposition ; restraining splints cannot be applied to the part itself, and it is difficult to maintain uniform ascendancy over the retracting muscles. If the periosteal investment (*ligamentum reflexum*) remain partially entire, however, there may be little displacement, and proportionally slight shortening ; and, in such circumstances, a better issue may be looked for—as well as in the case of impaction. 2. There can be no provisional callus ;

there being no structure, after it has been produced, in which it may be sustained ; the synovial capsule is obviously barren in this respect. The fractured ends may be said to be steeped in an increased secretion of synovia. 3. Also the definitive callus, which, if uninterrupted, would alone achieve consolidation—as happens in other fractures—is ever liable to accident, by even slight movement of the parts. 4. The upper fragment, or head of the bone, nourished only through the round ligament—and vessels of the ligamentum reflexum, should any portion of it remain untorn—must be of weak power, and ill able to execute the exalted nutritive action necessary for reparation. 5. The age of the patient, and the atrophied condition of the bone itself, are obviously unfavourable to reunion.

With such adverse complications, it is no wonder that examples of union in this fracture are most rare. And yet circumstances may occur, in which that result may be attempted and expected, with every reasonable prospect of success. When, for example, the patient is comparatively young ; when the shortening is slight, indicating but partial division of the periosteal investment ; or when, besides this, there is absence of crepitus, indicating impaction ; when the patient joins heartily with the surgeon in the use of means calculated to maintain apposition, and to prevent all movement of the fragments ; and when neither become weary of the prolonged period of vigilance required for the definitive callus to consolidate. The ordinary result, however, is the formation of a false joint ; the parts becoming accommodated to each other by absorption, connected by new fibrous texture, and further restrained by a thickened state of the capsular ligament ; the limb remaining deformed, shrunken, and comparatively powerless, yet admitting of tolerable usefulness, with the aid of a stick or crutch. In the extremely old, fatal sinking is probable ; under the shock of the injury, and the irritation of pain and confinement.

In the last-named class of patients, the use of splints and bandaging for retention of the fragments is not expedient. Success cannot result ; the annoyance will but aggravate the general disorder ; and, not improbably, sloughs will form at the points where the splint exerts its pressure. It is sufficient to arrange the limb comfortably on pillows, forming a double inclined plane, and by very gentle swathing or deligation to restrain motion. In the more hopeful cases, the long splint is to be applied as in treatment of the following injury.

II. *Fracture external to the Capsule, and above the Trochanter.*—This is usually an impacted fracture ; the upper fragment being driven into the cancellated textures between the trochanters, and more or less firmly wedged there. In such circumstances, there is but little displacement ; crepitus, even, may be obscure ; and the power of the limb, both as to motion and the sustaining of weight, may be wonderfully preserved—continuity in the bone having been restored by the impaction, immediately after it had been dissolved by the fracture. Not unfrequently, however, impaction is not so complete as this ; and sometimes it neither does nor can occur, on account of comminution attending on the fracture ; and then the amount of displacement and shortening may be very considerable. This form of injury usually results from

direct and severe violence, as by falls or heavy blows acting on the trochanter. It differs from the preceding ; in the mode of occurrence, as just stated ; in its liability to occur at any age ; in a greater amount of swelling, ecchymosis, and pain following—the fleshy textures being more or less extensively implicated ; in a greater amount of constitutional sympathy being manifested—the injury being altogether more severe ; in there being a feeling of enlargement of the trochanter and outer trochanteric region of the bone ; in the trochanter appearing more prominent, and describing the arc of a larger circle than on the sound side ; in there being usually a greater *immediate* and a less *ultimate* amount of shortening and eversion, with a greater amount of power and motion ; and in crepitus being very palpable, only when full extension and consequent disentanglement have been effected—obscure, or altogether wanting, until then. When impaction has not occurred, often the slightest motion causes very distinct crepitus ; there being comparatively little retraction of the lower fragment. The degree of shortening may be said to vary from half an inch to an inch and a half, but is never greater than it appears at first.

A more important difference exists, in this fracture being capable of satisfactory union. Hence the value of being able to distinguish between the intra-capsular and extra-capsular forms. In some cases of extra-capsular fracture, inversion, instead of eversion, of the limb occurs, which is due to the line of fracture extending through the trochanter major ; leaving the anterior portion of this, into which the anterior fibres of the gluteus medius are inserted, alone continuous with the shaft.

The best mode of treatment is by application of the long splint. It should extend from a little below the axilla, to six inches beyond the sole of the foot, when the patient is straight and recumbent ; and, having been well padded, more especially at the intervals between the points where pressure is likely to be greatest, it is made one with the limb, as it were, either by bandaging, or by preliminary swathing of a broad, linen sheet. Then a soft silk handkerchief is passed beneath the perineum, on the affected side ; and has both its ends tied on the upper end of the splint—there being two holes placed there for the purpose. A broad bandage or belt is also applied firmly round the pelvis, so as to bind the splint more securely on the limb, and keep the broken surfaces in apposition. By many, tightening the perineal band, from time to time, is recommended, that thereby the splint may be forced downwards ; and thus extension of the limb is attempted to be maintained against the contraction of the muscles. Indeed, in practice, some have such confidence in the powers of extension thus maintained, that they speak of actual elongation of the limb being sometimes the result—a result, however, which they admit is apt to disappear so soon as the patient attempts to resume the use of the lower extremities. Various ingenious splints and apparatus have been devised by our American brethren, having the extension and counter-extension of the limb as their special aim. The simplest of these splints is probably that of Dr. Kimball of Lowell, Massachusetts, and is the joint invention of himself and his nephew, Dr. G. K. Sanborn. The appliance for extension—adhesive plaster—was introduced in 1844 at the Pennsylvania Hospital by Dr. E. Wallace of Philadelphia ; was described

in 1830 by Dr. Gross, as successfully employed by Dr. Swift of Easton ; and was eventually brought into general notice and use by the active advocacy of Dr. Crosby in 1850 and 1854.*

One long piece of strong adhesive strap is first applied, extending from above the knee to the ankle ; there a loop is left, and the plaster carried up again as high upon the opposite side. Instead of one band on each side, two may be employed, which traverse each other somewhat obliquely, so that one band falls a little in front of the malleolus, the other a little behind. To protect the ankle from pressure, cotton wadding should be placed between it and the bands ; and to secure this more thoroughly, a piece of thin board, broader than the ankle, should be placed in the extremity of the loop. To fix the plaster to the limb, either a roller bandage is applied, or three straps of adhesive plaster are carried round the limb, one above and one below the knee, and another above the ankle. The splint, as represented in the diagram (p. 539), having been applied, the loop is secured to the cross-bar at the splint's extremity ; and the limb is made one with the splint in the ordinary way. By turning the screw, the cross-bar is moved up or down, at will ; and extension consequently is regulated with both accuracy and power. The perineal band is employed besides ; but when its pressure proves at any time galling, it is temporarily discontinued, and the crutch of the splint moved up into the axilla to supply its place. Dr. Gilbert of Philadelphia believes that adhesive plaster, applied spirally round the upper part of the thigh, may be employed as successfully in making counter-extension as in extension.†

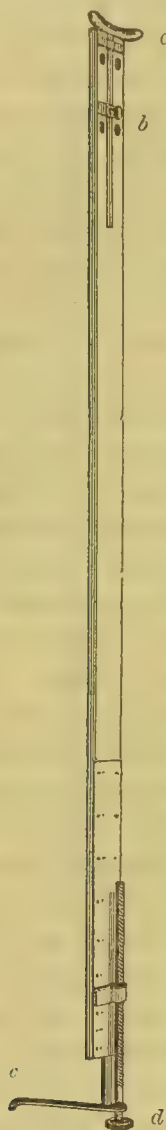


Fig. 353.

By others, again, all attempts at extension, except where the shortening is something unusual and excessive, is regarded as not only useless but even dangerous ; and, as Malgaigne says, common prudence should lead the surgeon to expect a moderate degree of shortening in these cases. By such, accordingly, the long splint is not employed as a means of effecting extension and counter-extension, but merely with the view of keeping the broken bone as completely at rest as possible, and, by maintaining the muscles in a state of repose, to prevent the occurrence of further shortening at a later period ; while, at the same time, the tendency to eversion of the foot is prevented.

* This method of dressing fractures has been more particularly brought into notice by Dr. JOSIAH CROSBY, of New Hampshire, U.S. ; N. H. Journal of Med. for 1851 ; N. Y. Journal of Med., vol. vi., 2d series, p. 137 ; Trans. Amer. Med. Assoc., vol. iii. p. 382 ; American Journal of Med. Science, Jan. 1854.

† American Journal of Medical Science for 1851.

Fig. 353. The American splint. *a*, The movable crutch ; *b*, the screw which fixes the crutch ; *c*, the cross-bar, to which the ends of the strap are fastened ; *d*, the moving screw.

On discontinuing the splint, at the usual time—from four to six weeks—a considerable amount of œdematous swelling generally pervades the whole limb; removable by friction and bandaging. Weight should be placed very gradually on the foot, especially in the aged, and in those of infirm health; for, in these, even slinging of the foot, in attempts to walk with crutches, has caused serious displacement of the fracture.

III. *Fracture through the Trochanters.*—This, which is merely a form of the extra-capsular fracture of the thigh-bone, is also the result of direct and severe violence. There is usually much displacement; and, in consequence, crepitus may at first be obscure. On extension and rotation, the hand, placed over the trochanter, ascertains that the upper fragment is fixed, while the lower alone moves with the thigh. Treatment is by the long splint.

IV. *Fracture of the Trochanter Major.*—This process may be broken off from the shaft of the bone; but such an accident, without solution of continuity of the neck of the femur, must be excessively rare. There may be no displacement, the fibrous tissues around the line of fracture remaining uninjured; in other cases, the separation produced by the lesser glutei muscles may amount to an inch and three-quarters (Hargrave), or the trochanter may be broken into fragments (Clarke). The displacement has usually been observed in a direction upwards and backwards; sometimes, however, and exceptionally, the fragment has passed upwards and forwards. This fracture occurs usually in young persons; seldom, if ever, in the aged. The symptoms are obscure; displacement in some cases, and the absence of laceration of the periosteal fibrous tissues in others, preventing the recognition of crepitus. Pain on pressure over the trochanter, and on forced adduction or abduction, with the fragment felt detached from the upper part of the shaft of the bone, without the existence of any loss of continuity in the neck or shaft, are the only constant signs of the injury. Accurate approximation and retention are effected with difficulty where there is separation; and, in consequence, union in such cases can only be by ligament. Splints or bandages are unnecessary; it is sufficient to maintain recumbency, with the thigh abducted and rotated outwards.

V. *Fracture below the Trochanter Minor.*—The indications of this accident are sufficiently plain. The end of the upper fragment projects outwards by the action of the psoas and iliacus, and of the muscles inserted into the trochanter and trochanteric fossa, and also in no small degree by the pelvis settling down into a hollow in the bed. By the muscles of the thigh, the condyles of the femur are drawn inwards; and as the whole limb lies upon its outer side the upper end of the lower fragment forms an angle with the upper. The consequent deformity and shortening are great. Extension and rotation cause distinct crepitus; and the preternatural mobility of the part, with loss of continuity in the shaft, are very apparent. Adjustment having been made, by extension and coaptation, the limb may be secured to the long splint; and sometimes it is expedient, in addition, to place pasteboard splints directly on the fractured part—one on the inside, extending from near the perineum, one on the outside extending from the trochanter major, and both reaching to the knee. They are secured by loop bandages,

before the long splint is applied. In all cases when the straight position is employed, a stout flat board of wood should be placed beneath the mattress to prevent it from sinking, and thus rendering the displacement greater than it would otherwise be. But, in some cases, the double-inclined plane may be preferable—MacIntyre's splint, simplified and improved by Liston; the displacement of the upper fragment being thus humoured, while the lower part of the limb is brought up to it. Some have advised that the trunk should also be somewhat elevated; to relax the muscles of the minor trochanter. But this can only increase the sinking of the pelvis, with the consequent risk of further deformity from increased displacement of the upper end of the bone. Whatever plan is pursued, the great and important indication is to keep the limb as steady and as nearly straight as possible, and to prevent eversion of the foot. In children, a starched apparatus, with a leather splint moulded to the hip and outer aspect of the thigh, will generally serve better to keep the parts in position than any more formal apparatus. In such cases, it is well to varnish the bandaging; and so to prevent the necessity for frequent renewal of dressings on the score of cleanliness.

VI. *Fracture of the Shaft near its Middle.*—Here the signs of the injury are self-evident—pain, powerlessness, mobility, crepitus. Displacement is usually great, and the deformity well marked. The upper fragment, at the seat of fracture, lies in front; both fragments together form an angle outwards, and the foot and limb below the seat of injury are rotated outwards, the foot lying on its fibular side. The fracture is usually a comminuted one, or oblique; rendering it therefore difficult to bring the broken surfaces into such apposition as shall prevent displacement and shortening of the limb ensuing, however careful the treatment. The retentive apparatus should consist of the long splint. Malgaigne, however, recommends the double-inclined plane; the latter bent to a tolerably acute angle, so as to make the weight of the pelvis and trunk a means of effecting the requisite extension.

In ill-adjusted cases, not only is deformity great by shortening, eversion of the foot, and angulation at the part; the knee is apt to become weak and loose; the ligament of the patella, from relaxation of the quadriceps, proving altogether inert.

VII. *Fracture above the Condyles.*—This is usually the result of direct violence. The line of fracture is nearly transverse. Sometimes there is no appreciable displacement, and then the crepitus is with difficulty detected; sometimes the displacement is lateral, but more commonly the upper fragment projects forwards, pushing the patella before it. The lower fragment has been represented as passing backwards, by the action of the popliteus and gastrocnemius. This, however, is a mistake; apparently originating with Boyer, and diligently copied from him by more modern writers. The lower fragment really retains its place, and only seems to project towards the popliteal space, because of the displacement of the upper fragment, which may be so considerable as to penetrate muscles and skin, and so render the case compound. Effusion into the knee-joint is a constant accompaniment of this fracture; and may prove a serious inconvenience; not only from the acute symptoms which may attend upon it during treatment, but by afterwards

entailing, as it usually does, a stiff joint for a lengthened period, if not for life. The signs of the injury are obvious and plain. Treatment may be satisfactorily effected either by means of the long splint, or by the double-inclined plane, with the knee considerably bent.

VIII. *Diastasis*, or separation of the shaft of the bone from its epiphysis, may take place in the adolescent; simply, by direct violence; or with more or less rotation of the detached part, the limb having been twisted by a wheel, or in machinery. Retention is best effected in the straight position; with the use of common splints, of wood or paste-board; or laying the limb in MacIntyre's splint, fully extended.

IX. *Fracture of the Condyles* may take place as an accompaniment of fracture above the condyles; or it may be an oblique fracture splitting off one or other of the condyles themselves, and extending into the knee-joint. There is much swelling of the joint, and crepitus is felt on the slightest motion. There is always some lateral displacement of adduction or abduction, according as it is the internal or external condyle which has suffered. When both are split up, the whole articulation is rendered preternaturally movable, and the width between the condyles is increased. These fractures are best treated in the straight position. But watchfulness and activity are especially requisite, to avert inflammatory accession, which is apt to seize upon the synovial capsule, and to prove severe. After the first fortnight, to prevent stiffness, gentle passive motion of the joint is expedient; provided the parts are quiet enough to admit of this.

In all fractures of the thigh the limb's use must be resumed very gradually, crutches being employed to bear weight at first, lest bending and shortening occur after apparent consolidation. And this precaution, indeed, is necessary in all fractures of the lower extremity—especially in patients enfeebled by age or disease, as already stated.

X. *Fracture of the Thigh complicated with Wound, and Compound Fractures* of the thigh, especially at the upper part, are prone to an unfavourable issue; by suppuration and constitutional disturbance. No peculiarities of treatment need be specified. The long splint, with a hiatus, occupied by a firm iron arch corresponding to the site of the wound, usually fulfils every indication requisite for the satisfactory treatment of the case. Fractures of the thigh caused by gunshot wound usually demand immediate amputation. And the patient's fate, in cases where an attempt is made to save the limb, usually hinges on the prophylactic and antiphlogistic constitutional treatment of the first ten days. The progress of the case must be expected to be tedious; and in many instances, although an effort may be made to save the limb, secondary amputation will too probably be required on account of the extensive necrosis which follows.

Fracture of the Patella.

Longitudinal or vertical fracture of this bone is a rare accident; when it occurs, it is usually the result of direct violence, and may be attended with comminution. Inflammatory accession is liable to ensue, implicating the joint; and active prophylaxis, in this respect, is in consequence essential. The fibres of the vastus externus, and of the vastus

internus, tend to displace the two halves of the bone in a lateral direction, to an extent equal to the thickness of the little finger (Vander Wiel). Where, however, only a small portion of the outer or inner side of the patella is broken off, it alone is displaced, the larger portion of the bone retaining its position. Bony union readily forms where there is no displacement. When, however, permanent separation exists, the union is effected by fibrous tissue alone. No complicated apparatus is necessary; it is sufficient to prevent motion, by a short splint under the ham, retained by bandaging; or displacement may be prevented by the application of lateral compresses retained by strips of adhesive plaster.

Transverse fracture is common. It may be produced by falls upon the knee, or by violence acting directly upon the patella. When the patient sustains the fracture by falling upon the knee, the articulation is not flexed at right angles as has commonly been stated; the limb has usually been straight, and in that position the patella has impinged upon some prominent surface, such as a stone or the edge or corner of a step. In such circumstances, too, the simple transverse fracture is rare; a multiple or stellate fracture, by which the bone is broken into three or more principal fragments, being more common. The simple transverse fracture is, in point of fact, the result more frequently of muscular action than of direct injury—as when a person, in full exercise, endeavours suddenly to save himself from falling. In other words, when the knee is bent, and the quadriceps extensor mass of muscles acts violently, the patella is apt to be broken across, over the condyloid surface of the femur, just as a stick is broken over the knee (Sanson). The line of fracture is not always transverse; frequently it is more or less oblique, from above downwards, and from without inwards. When this line of fracture occupies the lower third of the bone, it is usually produced by muscular contraction when the knee is bent. When in the upper third, it follows from a like cause, when the joint is completely extended. The displacement, when present, consists, in all cases, of a separation of the osseous fragments; and the degree varies considerably. The lower fragment remains *in situ*. The upper portion is retracted upwards on the thigh, by the extensor muscles—when the severance of fibrous as well as of osseous texture is complete; and a wide hiatus is left between, especially when the knee is flexed, in which the condyloid surface of the femur may be plainly felt—and even seen. The limb is powerless, more especially when descent in progression is attempted; the extensor muscles proving impotent.

Treatment is usually simple; position often being alone sufficient to effect reduction and retention. The limb is straightened and elevated, so as to relax the extensors on the thigh; a bandage is applied, from the toes upwards, to prevent engorgement of the limb; and, if coaptation be not quite complete, the bandaging may be arranged in the form of the figure 8, at the knee, so as to force the fragments gently into apposition. The trunk is also elevated in a half-sitting posture. Accurate apposition and osseous reunion may be obtained; but the result is not always satisfactory; the knee proving crank and limited in its movements, and recurrence of the fracture being by no means improbable, under the application of a comparatively slight cause. Short

ligamentous union is all that usually results ; affording sufficient firmness and resistance for action of the muscles, apparently leaving the play of the joint less fettered, and proving less liable to recurrence of a solution of continuity. When the separation is great, the uniting medium between the fragments consists merely of the fascia of the limb thickened by interstitial change, which, although commonly described as constituting a long ligamentous union, is in reality no ligament at all. As the consolidation advances, passive motion is gently begun ; otherwise the muscles may prove slow in recovering their function. Dr. Sanborn of Lowell, Massachusetts, treats these transverse fractures by means of a long strip of adhesive plaster (four feet long, and two and a half inches wide), applied along the front of the thigh and leg, leaving a loop in the middle. A bandage is then applied above and below the knee to support the foot and limb, and prevent the plaster slipping. A hard compress having been laid over the upper margin of the patella, a small stick is put through the loop of plaster, and twisted from time to time so as to approximate the separated fragments of the bone.

Should peculiarities of the case render such simple treatment insufficient, and a ligamentous union of redundant length be threatened, more coercive measures are necessary. A broad leather belt is passed round the limb above the patella, and another below it ; by cross belts, tightened as circumstances require, the circular girths are brought together ; and their approximation includes that of the fragments of the bone. This may also be effected by means of bandages. Or Lonsdale's apparatus may be worn ; which has the advantage of avoiding constriction of the limb. In cases of non-union, the constant wearing of such an apparatus restores the limb to a great degree of usefulness. Lately a case occurred to me, in which it was found quite impossible to maintain satisfactory apposition of the fragments, on account of a large bulging in the thigh, caused by exuberant callus—the result of previous fracture, ill adjusted.

Malgaigne has invented a very simple apparatus for the treatment of transverse fractures of the patella, consisting of two pair of steel hooks with fine needle-points attached to plates, which slide upon each other, and thus admit of being approximated by an endless screw. The sharp hooks, introduced through the integument, are lodged in the upper and lower margins of the bone. Accurate adjustment of the broken surfaces is then effected by means of the screw. Malgaigne has obtained a successful result in one case of mal-adjustment and great separation, by the use of this apparatus, assisted by subcutaneous scraping of the osseous surfaces with a tenotomy knife.

Compound Fractures of the patella have generally an unfortunate issue ; the joint inflaming acutely, and becoming disorganized. Not unfrequently, amputation is required, to save life. In the case of such an injury, excision of the joint had better be performed as a primary operation, with the view of checking the inflammatory tension, and hastening the progress of the case to a satisfactory issue.

Laceration of the Ligamentum Patellæ.—Instead of the patella giving way, under intense muscular action, the ligamentum patellæ may be torn asunder ; causing a hiatus at the injured part, with pain, swelling, and lameness—the power of flexion being alone retained. Treat-

ment is conducted on the same principles as in the case of transverse fracture of the patella.

Fractures of the Leg.

Fracture of both Bones of the Leg may be the result either of direct or of indirect violence; a heavy weight falling on or passing over the part; or the patient falling, and alighting on his foot. In the former case, the fracture is usually transverse, and the bones give way at corresponding points. In the latter case, the fracture is usually oblique, and the bones give way, each at its weakest point; the tibia a little above the ankle, the fibula about two or three inches below its head. This latter form of injury is especially apt to occur, in falls or leaps from a vehicle in motion; and one or other of the sharp fragments may protrude through the integument, rendering the case compound. Treatment is well conducted by adjusting the fractured limb when laid upon its outer side, so as to relax the gastrocnemius and soleus mass. Side splints, extending from above the knee to beyond the foot, and made of pasteboard, having been thoroughly softened in hot water, are applied without any padding to the bare limb, by means of a roller bandage.

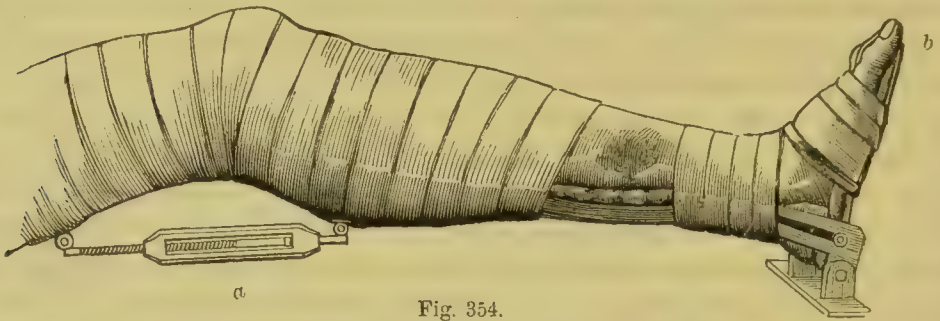


Fig. 354.

Over this, two wooden splints are temporarily fixed to prevent movement and maladjustment during consolidation of the pasteboard. When thoroughly dry, the pasteboard mould of the limb is removed, and having been padded with lint, cotton wool, or chamois leather, is re-applied, and kept in position by means of a loop bandage, or straps and buckles. Gutta percha may be similarly employed. In other cases, the double-inclined plane, in the form of Liston's splint, will be found best suited to keep the parts in good position. In employing this, to prevent undue pressure, it is well always, when practicable, to suspend the heel and foot by means of a sock—the end of which is hung, by a piece of tape, on a knob placed for this purpose on the upper and outer part of the footboard. It is also well, in some restless patients, to have the limb, in its splint or splints, considerably elevated, either by slinging, or otherwise. When the fracture of both bones is considerably above the ankle, the foot and lower fragments tend to pass backwards, producing a projection forwards and inwards of the upper

Fig. 354. Liston's modification of MacIntyre's splint. *a*, The screw which increases or diminishes the angle of flexion; at *b*, there should be a knob on the footboard, whereby the foot may be slung. The limb is arranged so as to shew the facility afforded for dressing the wound, in the case of compound fracture.

fractured surface. To remedy this condition, the "horse-shoe," "stirrup," or "spur-splint," is necessary; which consists of a straight piece of wood, three inches wide, extending from the knee to above the ankle, where it terminates in an arch with two projecting arms. The arch corresponds to the ankle-joint; the projections to either side of the foot—beyond the sole of which they should be long enough to project. A horse-hair pad is arranged between the front of the leg and the splint, and the apparatus is retained with the help of handkerchiefs or roller bandages. The effect of this form of apparatus is to draw the heel forwards, and with it the lower ends of the broken bones.

Fracture of the Head of the Tibia is the result of great and direct violence; the fracture extending into the knee-joint. Treatment is as for the analogous fracture of the femur, at its condyles. The limb is placed straight, so that the condyles may act as retaining splints on the fragments; and the limb is also elevated, so as to relax the extensor muscles, which, through the ligament of the patella, act on the lower fragment. Passive motion is expedient, so soon as consolidation has advanced so far as to admit of it.

Fracture of the Tibia immediately below its Tubercle.—The peculiarity of this form of injury is, the tendency to rising in the upper fragment, through agency of the muscles acting by the ligamentum patellæ. The rising is aggravated by flexion of the knee. The limb is therefore placed and retained in the straight posture, and elevated.

Fracture of the Tibia, at any lower point, is well treated with two side splints retained by loop bandages; the limb being laid upon the outer side on a pillow, with the knee completely flexed, and the patient resting upon the injured side. Or the case may be treated by means of Salter's swinging apparatus, or by the double-inclined plane. When this bone suffers alone, there is usually but little displacement; the fibula acting as a restraining splint. Crepitus, mobility, and pain at the seat of fracture, are recognized by carrying the finger, with steady pressure, along the spine of the tibia.

Fracture of the Fibula.—This bone most frequently gives way near

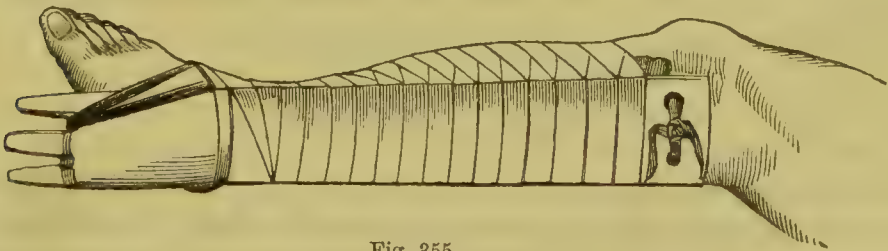


Fig. 355.

its lower extremity, at a short distance above the external malleolus. When force is suddenly applied, so as to cause eversion of the foot—as in twisting the foot, on the side of a stone, or in a gutter—this eversion is resisted by the external malleolus; but if the force be sufficient to overcome the resistance, the bone snaps at its weakest point—from two to three inches above the ankle-joint—and eversion of the

Fig. 355. Fracture of the fibula; with the splint applied. The foot should be more inverted.

foot is effected. There is immediate lameness, and the patient may be sensible of something having snapped in the leg ; the foot is found turned out ; and, if progression is attempted, the patient leans on the inside of the foot, so as to support himself on the tibia. A marked depression is observed on the outside of the limb, at the site of fracture ; and, on replacing the foot, and making rotatory movement of it, crepitus may be distinctly perceived. The deltoid ligament is ruptured ; and the end of the tibia projects, more or less, from the corresponding surface of the astragalus ; not unfrequently it is moved forwards on the dorsum of the foot. Treatment is by Dupuytren's splint ; a light piece of wood, in breadth proportioned to the limb, and of length sufficient to extend from the knee to a few inches beyond the ankle. It is applied on the inside of the limb ; provided with a pad—considerably thicker at the ankle than at the upper part. To a hole at the upper part of the splint a linen roller is attached ; and application of this is begun at the ankle—the bandage being occasionally turned over notches made for this purpose in the distal extremity of the splint, so as to maintain complete inversion of the foot, and consequent apposition of the fragments. The more thoroughly the foot is turned in over the malleolar pad as a fulcrum, the more sure are we of accurate readjustment. In effecting reduction, the knee is flexed, so as to relax the muscles of the leg ; and care is taken that replacement of the tibia is effected not only in the lateral but also in the antero-posterior direction. When the foot is forcibly twisted inwards, the extremity of the external malleolus may be torn off. In such circumstances, the foot usually regains its natural position, and no deformity is observable. The fracture is then apt to be mistaken for a sprain, and hence to be overlooked. The history of the case, however, and the pain and crepitus on manipulation of the part, will sufficiently indicate the site of the injury. In this case, simple side-splints should be applied, and the limb kept at rest, either laid on its back or upon its outer side.

Compound Fractures of the leg require no special notice. They are, in general, best treated on the double-inclined plane ; for the wound, being usually either in front, or on a lateral aspect, may be completely exposed, and frequently inspected and dressed, without the limb being at all disturbed, or the retaining apparatus undone.

Fractures at the Ankle.

Fracture of the Internal Malleolus is usually by direct violence, but may be produced by the same accident which gives rise to fracture of the fibula—viz., twisting of the foot outwards. The fracture may be either transverse or oblique. In the former case, displacement is marked and considerable ; the foot is dislocated outwards ; presenting its inner margin to the ground. In the latter case, the foot usually inclines inwards ; but in some cases the mobility of the malleolus alone indicates what has occurred. Sometimes, instead of only the malleolus being separated and the fracture extending into the joint, the fracture includes the whole thickness of the lower end of the tibia ; passing obliquely upwards. Replacement having been effected, by manipulation, while

the limb is flexed, Dupuytren's splint is applied on either the tibial or fibular aspect of the limb—or the stirrup splint is employed—according to the direction and nature of the displacement.

The External Malleolus may be detached, as we have seen, in a similar manner, by forcible inversion of the foot. When the foot is forcibly everted, as already stated, the fibula is more likely to give way at a point somewhat higher—its weakest part. The same splint is employed as in the more ordinary fracture of the fibula.

The Tarsal Bones are occasionally fractured; usually by intense and direct violence. In general, disorganization is such as to leave no hope of recovery; and primary amputation, consequently, is often required. The *Astragalus*, however, may be split and fissured perpendicularly and longitudinally, perpendicularly and transversely, and horizontally, by a heavy fall received on the calcaneum; there may be little or no displacement; and a satisfactory cure may ensue. By pressure upon the part, and twisting of the foot, mobility and crepitus are distinguished. An appearance of dislocation of the foot backwards has also been observed. The leg and foot are kept steady by lateral splints, or by means of the double-inclined plane. The tuberosity of the *Calcaneum* is described in most works on surgery, since the days of Garengeot, as liable to fracture from violent contraction of the muscles of the calf. The symptoms and treatment stated are the same as in the case of ruptured tendo Achillis. It is a curious fact, however, that not above eight cases of such a fracture are upon record. I have a specimen in which a fracture of the os calcis extends longitudinally and perpendicularly through the bone. This was caused by direct violence. Necrosis resulted, implicating in the inflammatory process the neighbouring bones and joints, and requiring ultimately amputation at the ankle-joint. Comminution of the os calcis from a crushing force, or from violence acting directly upon the tuberosity of the os calcis, is no uncommon injury. It is usually indicated by enlargement of the calcaneo-plantar region, and flattening of the arch of the foot. This lesion is liable to be mistaken for fracture of both malleoli. The most appropriate treatment consists in the application of a figure of 8 bandage to the foot and ankle.

Fractures of the Foot.

Fractures of the metatarsal bones, and phalanges, are seldom effected but by a crushing force. A wheel passing over the foot, a horse treading upon it, or the small foot of a sheep impinging on the metatarsal region in leaping over a fence, may fracture one or more of the metatarsal bones. From twisting the foot in making a false step, I have seen the fifth metatarsal bone fractured. The displacement is sometimes considerable, especially when several bones are broken; the proximal extremity projecting on the dorsum, the distal displaced towards the sole of the foot. The issue is rarely prosperous, especially when the lesion is compound. The metatarsal bones, after readjustment, usually require no splints. If, however, the patient is restless, a piece of gutta percha or wood, exactly corresponding to the outline of the sole of the foot, may be procured, padded, and retained by a figure of 8 bandage carried round

the ankle. In all such cases the foot should be kept at rest and elevated. The phalanges, if not demanding immediate amputation, are arranged and supported by small splints, retained by strips of adhesive plaster, as in the case of the analogous injuries of the superior extremity.

DISLOCATIONS.

Dislocation of the Pelvis.

From heavy and high falls, it has occasionally happened that one of the *Ossa Innominata* has been displaced upwards; separated from the sacrum, at the sacro-iliac junction, and from its fellow at the symphysis pubis. The following are the diagnostic marks of the injury:—The limb of the affected side is shortened and powerless; yet the signs both of dislocation and of fracture of the thigh-bone are absent; and the limbs, when each is measured from the anterior superior spinous process of the ilium, are quite of the same length. The spine and horizontal ramus of the os pubis are elevated; forming a hard ridge above and external to their ordinary site. The anterior superior spinous process, and the crest of the ilium, are on a higher level than those of the opposite side. By examination from the rectum, the tuberosity of the ischium will be found raised, and nearer the mesial line; and the descending ramus of the os pubis will probably be on a plane considerably posterior to that of the sound side. The fold of the nates is higher than on the other side; and, on the injured side of the sacrum, a depression will be felt, at the junction of that bone with the ilium. More or less difficulty may be experienced, in evacuating the bladder.

Should the nature of the case be distinguished in time, moderate efforts have been recommended to be made for readjustment; by extension of the limb, and forcing the ilium downwards with the hand. It is difficult, however, to see how retention of the articulating surfaces could be maintained, even should such reductive efforts prove successful. The bladder is to be relieved as often as circumstances may require; and if the urethra is displaced, a flexible catheter may possibly pass more readily than the metallic instrument. The same attention to the state of the internal organs is required, as in the case of fracture of the pelvis. Indeed, fracture of the os pubis is not unlikely to be associated with such an accident. Prognosis is unfavourable.

Separation of the *Symphysis Pubis* is said occasionally to occur, in difficult labour. It may also result from direct injury. Displacement is not great. By a broad belt the parts are kept unmoved, as well as in apposition.

The sacrum has sometimes been found, after death, forced forwards between the two innominate bones. The accident has been caused by direct violence.

Dislocations of the Hip.

The head of the femur may be displaced, in various directions. The displacing force is usually indirect; but the accident occasionally results

from direct blows or falls upon the hip or trochanter. It may take place at any time of life ; but most frequently affects the young or middle-aged adult. In youth it is rare—except in the congenital form ; in old age, fracture of the neck of the femur is much more likely to occur.

I. *Dislocation upwards and backwards on the Dorsum of the Ilium.*—This is by far the most frequent form of the injury ; usually resulting from a fall under a heavy weight, when the body is bent forwards, the limb being adducted and rotated inwards. Forceful rotation of the limb inwards has sometimes sufficed for its production ; and forcible flexion of the body upon the thigh, when fixed in a position of adduction and rotation inwards, favours its occurrence. The mechanism of the displacement varies with the degree of flexion. When the trunk and limb are nearly in the same straight line, the head of the bone is usually forced directly upwards and backwards through the tense upper part of the capsule. When, again, the limb and anterior surface of the trunk are flexed upon each other, the posterior and lower part of the capsule is torn over the head of the bone, which passes out of the articulation in the direction of the dislocation into the sciatic notch, and secondarily assumes the position upon the dorsum ilii. This distinction is of importance in effecting reduction of the dislocation. Examination is best made in the erect posture. The limb, shortened from an inch and a half to two inches,* is rotated inwards, and at the same time adducted, so that the toes rest on the opposite instep, the knee being somewhat advanced and carried across the front of its fellow. Motion is much abridged, especially in an outward direction. The trochanter is preternaturally near the anterior superior spinous process of the ilium. There is a hollow in the groin, and a diminution of the normal prominence of the trochanteric region. The roundness of the gluteal space is at the same time enlarged, though less broad than on the sound side ; and on manipulating this swelling, the head of the bone may be felt rolling in its new site, during rotation of the knee inwards.

Fracture of the neck of the femur, bruise of the hip, and morbus coxarius, are the conditions likely to be mistaken for this dislocation. It is hard, however, to see how, with a proper acquaintance with the symptoms of dislocation, any mistake should occur. Diagnosis rests on the following points :—In dislocation, the motions of the limb, both voluntary and forced, are abridged ; there is invariably adduction and inversion of the foot, and this adduction and inversion cannot be undone, until reduction has been effected ; the toes may be moved round forcibly, but the whole body turns with them ; on extension being made, the normal length of the limb cannot be restored, until reduction has occurred ; and then there will be no recurrence of the shortening, unless fracture of the brim or floor of the acetabulum co-exist. Eversion of the toes, so that the limb lies upon the outer side, can never exist in a dislocation upon the dorsum ilii. True crepitus is felt only in the case of fracture. The occurrence of dislocation is much more rare than that of fracture ; and, while dislocation may happen at any age, fracture within the capsule seldom if ever is found under the age of fifty. Fracture

* According to Malgaigne, the shortening never exceeds half an inch.

external to the capsule is at once known, by the distinctness of the crepitus—when extension and rotation are made, and when the trochanter is pressed inwards. Bruise of the hip-joint is recognised by negative signs ; any local symptoms simulating dislocation disappearing under the use of chloroform. Morbus coxarius is recognised by its history. When a patient is examined after a severe injury in a state of insensibility, the distinction between a recent traumatic and an old pathological or congenital dislocation is easily enough made out, by attending to the state of the muscles, and by observing the sole of the foot and shoe, to see whether or not the patient had walked normally before the accident.



Fig. 356.

When efforts at reduction are effected by extension and counter-extension, they may be made with or without the aid of pulleys and their auxiliaries, according to the date of the injury, the robustness of the patient, and the other circumstances of the case. The patient is placed recumbent on his back ; and extension is made obliquely across the opposite limb ; the thigh crossing its fellow a little above the knee. The laque, to which the pulleys are attached, is applied either above the knee (English surgery), or at the ankle (French surgery), as may be preferred. Counter-extension is made, by means of a strong belt—well padded—passed beneath the perineum, and

secured to a fixed point behind the patient. When extension has been maintained for some time, the limb is rotated outwards.

It is seldom that we find it expedient to forego the use of chloroform ; and when this is employed, in recent examples, success is almost sure to follow. In old standing cases, after six weeks have elapsed, the result is doubtful. With chloroform, no other mode of reduction need be tried than the simplest—that just stated. Other methods have, however, been employed with good success, and are well suited for emergencies, when no efficient assistance or apparatus is available. (a.) (Colombat)—The patient having been placed erect—resting his weight on the sound limb, stooping over a firm table, and having his pelvis fixed securely thereon—the surgeon takes hold of the foot of the affected limb with one hand, and, flexing the leg on the thigh, presses steadily downwards with the other hand, or with his own knee, on the popliteal space. After extension has thus been applied for some time, sudden rotation is made on the hip ; and the bone may, thus simply, move at once into the acetabulum. (b.) Since the days of Hippocrates, with more or less modification, forced flexion of the leg upon the thigh, and of the thigh upon the abdomen, combined with rotation inwards, followed by a movement of abduction or circumduction, terminating in extension of

Fig. 356. Dislocation on the dorsum ilii.

the limb, has been recommended, and has apparently been found very successful. With this proceeding the names of Richard Wiseman, Boulton, Turner, and Anderson* in our own country; and those of Physic, Nathan Smith senior and junior, among our American brethren, deserve special notice.

(c.) By some the following procedure is found satisfactory. I have, on two occasions, resorted to its use with an immediately successful result. The patient, lying upon his back, has his nates brought close to the side of the bed; an assistant fixes the pelvis; and the surgeon, sitting upon the edge of the bed with his back turned to the patient, takes the leg on the affected side over his shoulder, and, steadying the foot and leg with both hands, suddenly assumes the upright posture.

(d.) It has been proposed to effect reduction by the operator placing his heel upon the tuber ischii, and making extension with his hands.

After reduction, the patient is placed gently in bed; and no retentive means are necessary, unless he be careless, or violent—through chloroform, delirium, or otherwise. Then it is well to secure the two limbs together, by bandaging, at the knees and ankles; pads being interposed at these points. To relieve the uneasiness which exists for some time, hot fomentation should be diligently applied to the part. If, as rarely happens, the upper edge of the acetabulum have been broken, retention is effected with difficulty; and it is necessary to maintain permanent extension of the limb, by means of a long splint with perineal band, as in the case of fracture.

II. *Dislocation backwards, into the Ischiatic Notch.*—In point of frequency, this form may be placed next in order. It may be the primary form of displacement backwards, the head of the bone afterwards reaching the dorsum ilii; in other cases, again, the bone assumes this position, when efforts are made to reduce the dislocation backwards upon the dorsum of the ilium. “The head of the thigh-bone is placed on the pyriformis muscle; between the edge of the bone which forms the upper part of the ischiatic notch, and the sacro-sciatic ligaments; behind the acetabulum, and a little above the level of the middle of that cavity.”† The accident results from the application of force, while the body is bent forward on the thigh, and the knee is pressed inwards. The signs bear a general resemblance to those of the preceding injury, but occur in a minor degree. Hence the lesion is very liable to be overlooked and mistaken for bruise of the joint. The shortening is from half an inch to an inch. The foot is inverted, and the great toe rests on the ball of the great toe of the opposite foot. The trochanter is behind its usual place, and is slightly inclined towards the acetabulum. The head of the bone can seldom be felt distinctly. The joint is preternaturally fixed; flexion and rotation, in any considerable degree, being quite impracticable. The

* Works of Hippocrates, Syd. Edit. vol. ii. p. 643; Eight Chirurgical Treatises, by Richard Wiseman, London, 1676, book vii. c. viii.; A system of Rational and Practical Surgery, by Richard Boulton, p. 346, London, 1713; The Art of Surgery, by Daniel Turner, London, 1742, vol. ii. p. 339; Anderson (of Leith) Med. Commentaries, Edinburgh, 1776, vol. ii. p. 261-4; Physic Dorsey's Surgery, 1813, vi. p. 242; Trans. N. Y. S. Med. Soc. 1854, p. 55; Buff. Med. Jour. vol. xiii. p. 515.

† ASTLEY COOPER on Dislocations.

whole body cannot be straightened in the recumbent posture; if the trunk be smoothed down, the thigh rises up; and if the limb be forcibly and painfully straightened, the loins are found immediately and insuperably arched—and this, which is the most characteristic sign of all, will not cease, until reduction has been effected.

Reduction is made with the patient recumbent, on his sound side; and the affected limb is extended obliquely, so as to bring it across the middle of the sound thigh. After extension has been maintained for some time, the head of the bone is lifted over the margin of the acetabulum, by means of a jack towel placed under the upper part of the

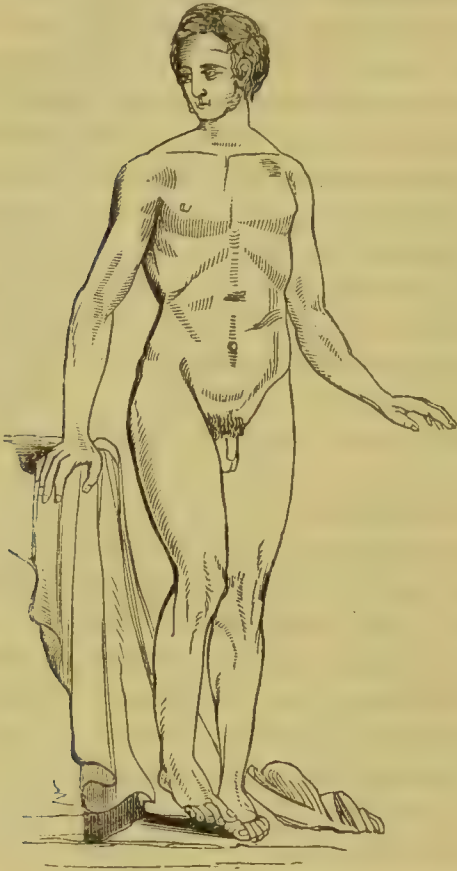


Fig. 357.



Fig. 358.

thigh; extension in that direction being made, by passing the loop of the towel over an assistant's neck, while counter-extension is exerted by the hands of another assistant resting firmly on the patient's pelvis. But it is not to be supposed that such movements are to interfere with the main extending force; the two are carried on consentaneously. This dislocation is also well suited for reduction by manipulation, as already described in the treatment of the former injury. In employing the manipulation method, as the head of the bone comes in contact with the edge of the acetabulum, there is a risk, if the abduction is too suddenly effected, of converting the dislocation into the next form of displacement.

III. *Dislocation downwards into the Foramen Ovale.*—This—as well as the following variety—is comparatively rare. It is usually

Fig. 357. Dislocation into the ischiatic notch.

Fig. 358. Dislocation into the foramen ovale.

caused by a heavy weight falling on the pelvis, while the trunk is bent forwards, and the thighs are separated from each other. The limb is elongated, to the extent of nearly two inches ; and is advanced in front of its fellow, the toes usually pointing forwards—but they may incline towards either inversion or eversion. The thigh is much abducted, and cannot be brought near its fellow. The trunk is bent forwards, during maintenance of the erect posture ; and the tense ridge, formed on the inside of the thigh by the stretched psoas and iliacus muscles, can generally be both seen and felt. The trochanter is flattened and depressed. The head of the bone can be made out—though only in thin patients, and in the absence of swelling—by pressure on the inner and upper part of the thigh towards the perineum. The position of the limb somewhat resembles that which attends on the first stage of morbus coxarius. A mistake in diagnosis would be fraught with the most direful consequences ; but, with ordinary care, such a misfortune is not likely to occur. The true elongation of the limb, and of the space between the anterior spinous process of the ilium and the trochanter major, is of itself a sufficient test of the dislocation.

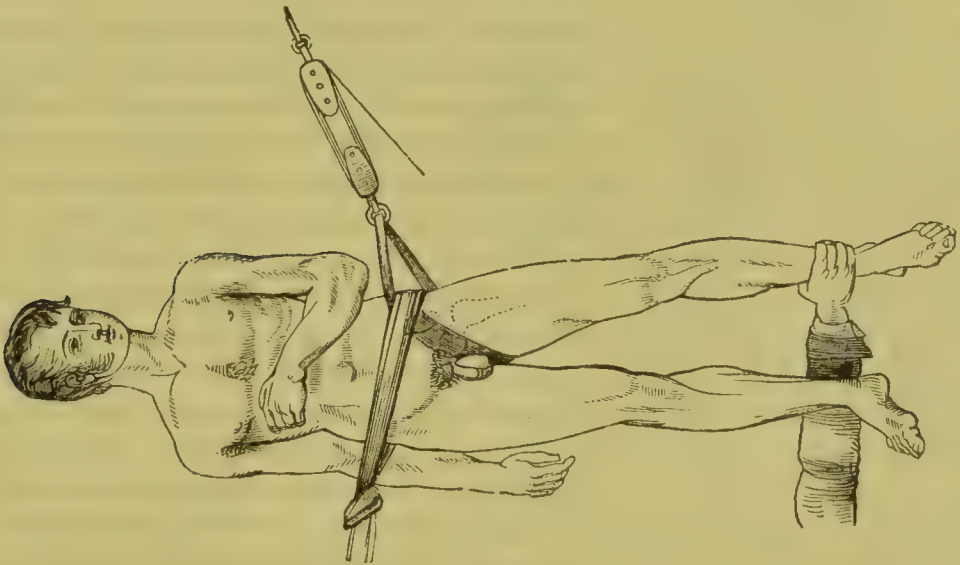


Fig. 359.

In employing extension and counter-extension, the patient is placed flatly recumbent. Here the limb is elongated ; and counter-extension is accordingly made, not in the axis of the limb, but across the pelvis, by means of a strong belt passed round it. Extension is applied in the opposite direction, at right angles to the pelvis ; the pulleys being attached by means of a loop passed under the upper part of the thigh, and with one portion of the loop brought over the belt whereby counter-extension is made. Extension is exerted gradually, until the head of the bone is felt moving from its abnormal site. The surgeon then, passing his hand behind the ankle of the sound limb, grasps the ankle of the dislocated member, and draws it inwards, towards the mesial line of the body. The foot should not be raised, lest the head of the bone slip into the ischiatic notch—a casualty, however, which is far from being irreparable.

Or, the patient having been placed recumbent, on the sound side,

Fig. 359. Reduction of dislocation into the foramen ovale.

and the apparatus arranged as before, extension is made directly upwards, while the knee and foot are pressed down. If we attempt the reduction by manipulation, it is even more necessary here than in the former cases, to carry the limb only in those directions in which it is found to move easily, lest fracture of the neck of the bone should be produced. The thigh is accordingly flexed in the abducted position; and when it has assumed a rectangular position with the trunk, the knee is gradually rotated into the position of adduction, flexion being meanwhile continued; and when the further progress of the knee towards the abdomen is stopped, the adduction is rendered complete, and the limb straightened. If the head of the bone threatens with every effort to glide away backwards into the sciatic notch, a slight rocking or rotatory movement of the knee, as the limb is being brought down, will usually coax it over the margin of the acetabulum.

IV. *Dislocation forwards on the Pubes.*—This accident happens when a person, while walking, puts his foot into some unexpected hollow; his body being at the moment bent backwards.

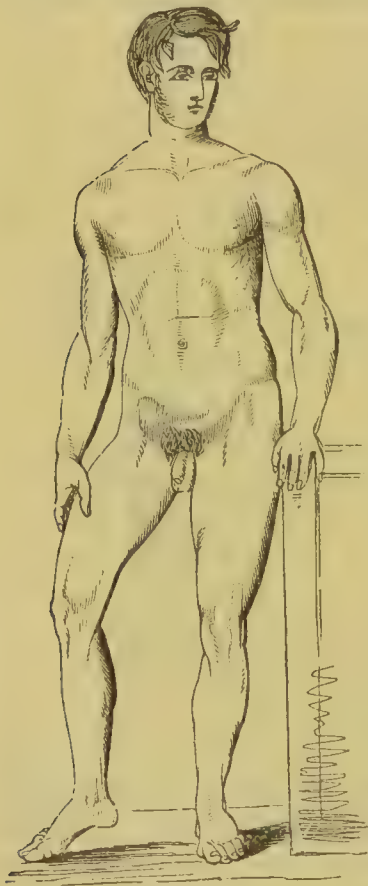


Fig. 360.

I have seen the accident produced by direct violence; the buffer of a railway carriage impinging against the posterior margin of the trochanter major. The head of the bone is forced upwards and forwards, on the horizontal ramus of the os pubis. The limb is shortened to the extent of an inch. The knee and foot are turned outwards, and cannot be rotated inwards. The head of the bone may be distinctly felt and seen, forming a globular tumour, resting above the level of Poupart's ligament, on the outside of the femoral vessels; and obedient to the motions of the thigh. The position of the head of the bone varies somewhat in different cases. I have seen it close to the anterior inferior iliac spine; and in that case, where the injury was the result of direct violence, and remained unreduced, the patient, who had previously suffered from a femoral hernia, had the vessels tilted forwards, and the crural canal supported from behind, so that he no longer required to wear a truss. This form of dislocation might, by an unwary practitioner, be more

easily mistaken for a fracture of the neck of the femur, than any of the others already described. But the immobility of the limb, and the bulge produced by the head of the bone, somewhere in the line of Poupart's ligament, will usually serve to preclude the risk of any mistake. Simulation may also occur, in the case of mere sprain of the hip or thigh, with globular extravasation of blood in the pubal region.

The patient is placed flatly recumbent on a table, with the affected

Fig. 360. Dislocation on the pubes.

limb projecting over the edge. Counter-extension is effected in the ordinary way, by the perineal band—secured behind, and a little above the

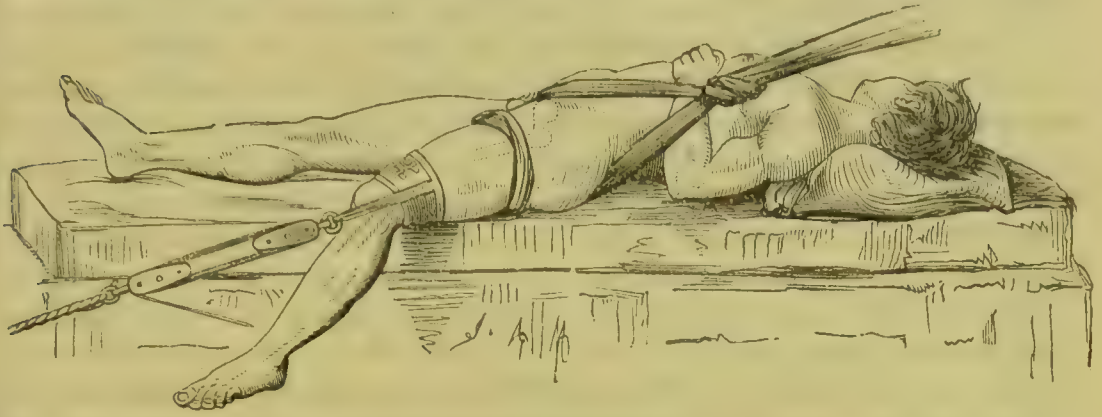


Fig. 361.

level of the patient. Extension is made in a line behind the axis of the body, carrying the thigh downwards and backwards. After some time, the head of the bone is lifted over the margin of the acetabulum, by means of a towel placed over the upper part of the thigh. And rotation inwards is also likely to be of service. The method by manipulation may here be resorted to with the most satisfactory effects. The direction of the rotation and circumduction, and of the rocking movements, must be regulated by the relation of the head of the bone to the margin of the acetabulum, and to the site of original rupture in the capsular ligament.

Anomalous dislocations of the Hip.—Besides the ordinary varieties of dislocation, the following have been observed :—1. As just mentioned, the head of the femur has been displaced, so as to rest on the anterior superior spinous process of the ilium—or rather on the space between the two spinous processes of that bone, the trochanter major lying on the dorsum ; such displacement having been determined by the direct effect of the force, and muscular action having, from some cause, failed to modify the movement in the usual way. 2. Or, in like manner, the head of the bone may rest on the anterior inferior spinous process of the ilium, the trochanter major lodging in the acetabulum. 3. The head of the bone has been found resting on the tuberosity of the ischium, and also upon the spinous process of that bone. 4. The head of the bone may pass downwards and backwards into the lesser or lower sacro-sciatic notch. 5. The head of the bone may quit the acetabulum and pass directly downwards. 6. The head of the bone may be displaced into the perineum.

Fracture of the neck or shaft of the femur sometimes complicates a dislocation of the head of the bone ; this, however, is a very unusual occurrence. Reduction of the dislocation, in such circumstances, is not likely to be effected ; as neither extension power nor manipulation can be brought to act upon the head and neck of the bone through the shaft.

Dislocations of the Knee.

Dislocations of the knee-joint are caused only by great violence, and

Fig. 361. Reduction of dislocation on the pubes.

are rare. The displacement cannot occur without much disruption of the retaining parts; and, in consequence, replacement is generally effected without difficulty.

The *Tibia* may be luxated from the femur, in five different directions:—1. *Backwards*, behind the condyles of the femur; causing shortening of the limb, prominence of the condyles in front, depression of the ligament of the patella, and bending of the leg forwards. Malgaigne distinguishes a complete and incomplete form of the dislocation backwards; and states that in the former the patella will be found situated horizontally beneath the condyles of the femur, while in the latter it is only inclined at an angle of 45 degrees. 2. *Forwards*.—The condyles are thrown back, and compress the popliteal vessels; the tibia and patella are elevated in front; the limb is shortened and slightly flexed. When in this form of dislocation the articulating surfaces pass clear of each other, and the injury is thus complete, the shortening of the limb is sometimes considerable, and the patella lies horizontally upon the surface of the head of the tibia; in the more common case, of a partial dislocation, it is inclined obliquely between the head of the tibia and inter-condyloid fossa. These antero-posterior dislocations are more nearly complete than the other two, which are always only partial. 3. *Inwards*.—The internal condyle of the femur rests upon the external semilunar cartilage; and the tibia projects plainly on the inner side of the joint. 4. *Outwards*.—The external condyle rests on the inner semilunar cartilage; and the projection of the tibia is on the outside of the joint. 5. Displacement by *rotation*, usually outwards; a very rare injury, recognised by the foot being laid on its outer side, while the internal articular surface of the tibia projects in front beneath the intercondyloid notch, the inner condyle producing a well-marked protuberance above, and to the inner side.

Reduction is in general readily effected by extension and coaptation. Antiphlogistics are required subsequently, to ward off or modify the intense inflammatory seizure, which is apt otherwise to ensue after so serious an injury. The compound luxations usually require either immediate amputation, or excision of the joint.

Gradual displacement of the knee, by muscular action, in the case of advanced structural change, has been already considered.

The *Semilunar Cartilages* are sometimes displaced, by twisting the joint; as when a person, in walking, with the foot everted, strikes the toes against an obstacle; or when the foot, in walking, becomes suddenly caught in a crevice or hole. Perhaps there is a predisposing cause in operation—namely, unusual relaxation of the retaining ligaments of these structures. One or both of the cartilages is pushed from the normal site, by the condyles of the femur, which are thus unduly separated from the head of the tibia. The limb is immediately rendered stiff, and incapable of bearing weight; and a sickening pain is felt. Extreme flexion of the joint, by disengaging the parts, usually suffices for restoration of the normal state; the cartilages, by their elasticity, seeking their own place, when free. The production of such flexion may require force, and is painful. After the joint has remained a little in that position, the limb is brought down again with a sudden movement. The knee remains

weak and swollen for some considerable time—perhaps the seat of rheumatic pains ; and the use of a knee-cap is expedient. If chronic structural change threaten to ensue, that must be opposed by the ordinary means.

Dislocation of the head of the Fibula is a rare accident. It may take place, by violence, either backwards or forwards. Reduction is effected by direct coaptation ; and bandaging sufficiently effects retention. Should displacement depend on relaxation of the retaining ligament, the pressure of a knee-cap or bandage is necessary ; with stimulation of the part, to restore the normal state if possible.

Dislocations of the Patella.

The Patella is liable to be displaced, in various directions ; by external violence, applied directly or indirectly. But such accidents are rare. 1. *Outwards*.—This is most commonly caused by muscular contraction ; and is apt to occur in persons who are knock-kneed, and in whom the external ridge of the articulating surface of the tibia is slightly developed. The bone is thrown outwards on the external condyle, and forms a manifest projection there ; while the knee is incapable of flexion. 2. *Inwards*.—This is the result of direct injury ; the bone being struck on its outer side, while the foot is turned inwards. The mal-position is the reverse of the preceding. Reduction in either case is effected by raising the leg and thigh and flexing them on the abdomen, so as to relax the extensor muscles on the thigh, fully ; at the same time, with the hand, forcing the bone back to its place.

3. The patella may be displaced by *Semi-rotation* ; one edge resting on the middle of the articular surface between the condyles of the femur, while the other projects beneath the tense integument. Reduction in this case is to be effected by flexing the knee to the utmost ; so as to free the bone, and admit of its being drawn into its normal position by the action of the extensor muscles. Should this means fail, it may be expedient to divide the ligamentum patellæ, by subcutaneous incision.

4. The bone can be displaced *Upwards* ; but only on division of the ligamentum patellæ, by wound or tear. The treatment is as for transverse fracture of the patella. 5. Slight displacement, *Downwards*, may follow rupture of the tendon of the rectus muscle.

Dislocations of the Ankle.

I. *Dislocation of the Tibia inwards*.—This, as already stated, usually co-exists with fracture of the lower end of the fibula. The foot is everted ; and the internal malleolus projects greatly. Reduction is effected by extension of the foot ; while the limb is bent at a right angle, so as to relax the gastrocnemii muscles. And this flexed position of the leg, be it remembered, is essential in the treatment of all luxations at the ankle. Replacement having been accomplished, Dupuytren's splint is applied on the inner side of the limb ; and should it seem necessary, for complete retention, a minor splint may be placed on the outer side also.

II. *Dislocation of the Tibia forwards*.—This, too, attends on fracture

of the fibula. It may also occur independently of fracture ; but then the fibula is usually displaced along with it ; and the case is one of luxation of both bones.* The tibia rests on the upper surfaces of the navicular and internal cuneiform bones, and on a small part of the anterior surface of the astragalus. The foot is fixed, and appears much shortened ; the heel is proportionately elongated ; the toes are pointed downwards ; there is a marked depression in front of the tendo Achillis ; and the end of the tibia is felt to be resting on the middle of the tarsus. Treatment is as in the former case ; a splint being applied on each aspect of the limb.

A minor form of the injury may occur ; the end of the tibia resting partly on the navicular bone, and partly on the astragalus.

III. *Dislocation of the Tibia outwards*.—In this case, the fibula is associated in the displacement ; and both bones form a manifest projection on the outer aspect of the joint. The foot is turned inwards, its outer edge resting on the ground ; and the toes are pointed downwards. The internal malleolus is obliquely fractured and detached. Treatment is as in the other cases. But especial watchfulness is necessary, as to the consequences ; this form of injury being always the result of much violence, and inflammatory mischief being consequently apt to ensue.

IV. *Dislocation of the Tibia backwards* is extremely rare. The end of the bone rests on the os calcis, in front of the insertion of the tendo Achillis ; the heel is shortened, and the foot is proportionately elongated.

The foot has also been found forced upwards between the tibia and fibula ; these having separated. But this may be regarded as merely an aggravation of dislocation of the tibia inwards.

The treatment is still by extension of the foot, during flexion of the leg ; and by the application of lateral splints.

V. *Compound Dislocation of the Ankle*.—This is the most common of the compound dislocations of joints ; and, although it may occur outwards, usually takes place inwards. The patient having fallen forcibly, with the foot everted, the end of the tibia is driven through the integuments on the inner aspect of the joint ; and protrudes to a greater or less extent. Even in extreme cases, the posterior tibial artery generally escapes untorn. When the dislocation occurs outwards, the end of the fibula is usually broken off, and displaced along with the foot. This accident may occur to any one ; but is especially frequent in adults of advanced years and intemperate habits ; and, in these, but a slight amount of violence would seem to suffice for its infliction. The complication of delirium tremens is not unfrequent.

Although reduction may be effected as in the simple form, and subsequent treatment, conducted according to general principles, may result in preserving a limb both seemly in appearance and useful to the patient, such a result must be regarded as rather exceptional. Accordingly, Sir Astley Cooper recommended immediate amputation as expedient ; “ when the ends of the tibia and fibula are very much shattered ; when, in addition to the compound dislocation of these bones, some of the tarsal bones are displaced and injured ; when one or other of the tibial arteries is

* I have seen the tibia displaced forwards and inwards—the dislocation all but compound—while the fibula remained not only in its place, but entire.

divided, and cannot be secured without extensive enlargement of the wound, and disturbance of the soft parts ; when the common integuments, with the neighbouring tendons and muscles, are considerably torn ; when the protruded tibia cannot by any means be reduced ; and when the constitution of the patient is enfeebled at the time of the accident, and not likely to endure pain, discharge, or long confinement." Certainly when the accident is so complex, amputation at the ankle-joint, with removal of the extremities of the tibia and fibula as high as they are denuded of soft parts, should be performed ; or should the soft parts of the heel, or the blood-vessels and nerves at the site of the wound, be seriously injured, amputation of the leg at the point of election, four inches below the tuberosity of the tibia, may be required. In a simpler form of compound dislocation of the ankle, however, when the wound of the soft parts precludes all hope of union by the first intention, the protruding articular surface should be thoroughly disclosed by incision, and the end of the bone removed by the saw. Suitable splints are then applied, and by careful after-treatment the inflammatory process is moderated, so that ultimate consolidation of soft and hard parts ensues, and a useful limb, after a tedious confinement, is preserved for the patient.

Secondary hemorrhage may ensue from the posterior tibial, in a case otherwise affording a chance of cure. In such circumstances, if all the other points of the case are favourable, the bleeding vessel should be secured by ligature. But if there be profusion of unhealthy discharge, manifest indication of ulceration in the joint, or signs of incipient gangrene in the wound and on the foot—then amputation is to be performed, with as little delay as possible.

Dislocations of the Tarsus.

I. Of the Tarsal range of bones, the *Astragalus* is the most frequently displaced by violence. Its dislocation may be either complete or partial ; and it may take place in various directions. 1. *Forwards.* This is by far the most frequent form. When the ankle is fully extended, a large amount of the upper articular surface of the bone is exposed ; and if, by a fall, a powerful shock should then be applied to the calcaneum, the astragalus is very apt to be loosened and displaced—forwards and inwards—coming to rest on the navicular bone. Sometimes the displacement is forwards and outwards ; the bone resting on the os cuboides. The nature of the accident is at once declared, by the manifest appearance of the astragalus in its abnormal site. Reduction is to be attempted by persevering extension of the foot, with the leg flexed ; while the bone is pushed backwards to its place. And, with the aid of chloroform, we shall not despair of success in all recent cases.

If the luxation have been complete, and remain unreduced, tension of the integument will be such as to render sloughing inevitable at the tense part ; and the case so becomes compound. When the case is from the first compound, or when it ultimately becomes so by sloughing or ulceration of the strained and bruised integument, and also when the circumstances are such as to render it plain that sloughing or ulceration must soon occur—the luxated bone is to be removed by incision, the limb is

to be carefully adjusted, retention is to be maintained by the adaptation of suitable splints, and the case is to be treated as a compound dislocation of the ankle-joint. In cases where diffuse suppuration and sloughing have ensued in consequence of attempts to save everything without any operative interference, it may be necessary to resort to amputation, either at the ankle or below the knee, according to the condition of the soft parts. In partial displacement, no operative interference is necessary ; but the parts, whether replacement be effected or not, require to be kept at rest by the use of suitable splints moulded to the leg and foot.

In a case of partial dislocation, reduction was effected, upwards of a fortnight after the accident, by the help of chloroform, and subcutaneous section of resisting tendons.

2. The astragalus may be dislocated *Backwards* ; becoming firmly wedged between the tendo Achillis and the posterior surface of the tibia. The bone is readily felt in its unnatural site ; it is seen protuberant there ; and the end of the tibia is felt projecting in front. Reduction, for obvious reasons, must be extremely difficult. In only one case, probably, has the attempt ever proved successful, without chloroform—one which occurred to Mr. Liston.*

3. The astragalus has been displaced *Upwards* ; wedged between the tibia and fibula. But this accident is extremely rare.

4. Dislocation has taken place *Outwards* ; and it has also occurred *Inwards*. Such injuries are usually not only compound, but also complicated with fracture of one or other malleolus. They may be so severe as to demand immediate amputation at the ankle ; or they may admit of replacement of the limb, in the hope of saving it, after the dislocated bone has been removed.

II. *The Os Calcis and Astragalus*, retaining their position, may be separated from the other bones of the Tarsus ; the anterior part of the foot becoming displaced inwards, as in Talipes Varus. Reduction and retention are easy ; the former by extension and coaptation ; the latter by placing the limb on the double-inclined plane, and securing the foot firmly on the foot-board.

III. *The Cuneiform bones* may sustain displacement. Of these, the internal is most likely to suffer. The bone projects inwards, and upwards. Reduction will be difficult ; retention probably impossible. But, after a time, the limb may become little less useful than before, even though the dislocation remain unreduced.

Dislocation of the Metatarsus.

One or more of the metatarsal bones may be displaced upwards on the front of the tarsus ; the foot having undergone a severe wrench, as by a fall from horseback while the foot is retained in the stirrup. Under chloroform, the parts are easily reduced ; and no retentive means are necessary. Leeching, with other antiphlogistics, will probably be required, however ; such displacement not being likely to occur without the infliction of much violence.

* Lancet, July 6, 1839.

Dislocation of the Toes.

Luxation of the phalanges of the toes is rare. Reduction is readily effected, by extension and coaptation. Compound luxations usually require amputation.

SUBLUXATIONS AND SPRAINS OF THE LOWER EXTREMITY.

The hip is seldom sprained. The knee suffers not unfrequently. The twist is usually such as to strain the inner aspect of the joint; and there the ligamentous apparatus may partially give way. Pain is great and sickening; much swelling ensues, perhaps involving the synovial capsule; and the part is apt to remain weak, and prone to recurrence of the injury. In addition to the ordinary treatment suitable for sprain, the wearing of a knee-cap is essential for some time, until the part, by consolidation, regain its power of resisting the more ordinary applications of force.

Sprains of the ankle are extremely common; by twisting the foot, by a fall, or by a "false step." The most ordinary sprain is caused by twisting the foot inwards; and the consequent pain and swelling are on the outside of the foot—often great over the belly of the short extensor of the toes. Treatment is by rest, fomentation, leeching, etc. And an elastic bandage on the ankle is necessary, for some time, after walking has been resumed.

INJURIES OF THE TENDO ACHILLIS, AND OF THE GASTROCNEMIUS, SOLEUS, AND PLANTARIS GRACILIS MUSCLES.

Rupture of the Tendo Achillis.—By sudden and violent exertion of the sural muscles, as in leaping, dancing, or running—more especially if the patient be muscular, gouty, or rheumatic, advanced in years, and unaccustomed to such exercise—the tendo Achillis is apt to give way, close to or at its insertion into the calcaneum. There is immediate lameness; the patient falls, and is quite unable to resume the ordinary erect posture; much pain is complained of in the part; and, on manipulation, a very palpable gap is found at the site of injury. Usually there is, at the time of rupture, a sensation of something having given way; sometimes there is an audible snap; not unfrequently the patient complains of having been struck at the injured part, although no blow has been sustained there. Treatment is simple. Position, alone, suffices for replacement. The leg is bent, and the foot is extended, so as to relax the sural muscles completely, and favour approximation. This position is maintained by simple means. A slipper is placed on the foot; to the heel of the slipper a stout cord or tape is attached; and this is fastened to the thigh, by means of a circular belt applied there—or to the loins, in a like manner—as tightly as is necessary for securing the requisite degree of flexion. Bending may be voluntarily increased by the patient; and this does no harm. But extension is absolutely prevented. Reparation is slow; and the period of confinement requires to be enlarged, a

week or two, beyond that required in the case of fracture. After consolidation, extension is made gradually, lest the uniting medium be overstrained, and disruption of it ensue. The patient, when first allowed to move about, with a crutch or stick, is provided with a high-heeled shoe; and, every day or two, a thin slice is cut from this heel, so as to permit a gradual approach of the sole to full planting on the ground.

Wound of the Tendon is managed in a similar way. Accidental wounds—as by a scythe, knife, or reaping-hook—are usually compound. And, in them, the cure may be facilitated by approximating the two portions of tendon by means of silver wire suture.

Ununited Tendon.—Cases sometimes present themselves, in which rupture of this tendon has not been repaired. The retracted portion has become rounded off; the calcaneus fragment is similarly changed; and the space between is occupied by a mere shred of uniting material, quite inefficient for restoring function to the muscles. The hiatus being considerable—perhaps to the extent of two inches, or more—the limb is quite useless in progression. To remedy this state an inci-



Fig. 362.

sion may be made, the rounded ends of the tendon may be cut off, and approximation may be effected by suture. But this is severe practice. I have applied, quite successfully, the principle of subcutaneous section; by a stout needle making raw the extremities of the tendon, and breaking up the intervening space completely; so restoring the parts to a resemblance of their condition immediately after the original injury; applying the same simple, retentive, and approximating apparatus, as after recent rupture; and, after consolidation, employing the same caution in permitting resumed use of the limb.

Laceration of the Muscle.—Instead of tendon giving way, the muscular fibres of the gastrocnemius, soleus, or plantaris gracilis, may yield. The laceration seldom implicates more than a few of the fibres; and the site of injury is usually where the muscular fibre ceases and tendon begins. The causes are the same as those of the former lesion; the symptoms are very similar, and the treatment consists in keeping the parts at rest, supported by a bandage.

Fig. 362. Outline of limb, shewing the slipper and ligature useful for maintaining flexion in ruptured tendo Achillis.

CHAPTER LXVIII.

AFFECTIONS OF THE FOOT.

Talipes.

By this term is understood the deformity of *Club-foot*; generally congenital; yet, not unfrequently, acquired. The original development of the bones is not faulty; but displacement of these with change in form, more especially affecting their articular surfaces, is gradually effected, by a predominance of action in certain muscles; such predominance being dependent either on spasm of those which so act, or on want of action in those which ought to be their antagonists. There is no actual dislocation of the tarsal bones; there is merely gradual change in their relative conformation and positions. A case is related by Delpech which well illustrates the mode of production. A soldier had the "external popliteal nerve injured by a shot;" the peronei, the tibialis anticus, and the extensor muscles, became paralytic in consequence; and from the unopposed action of the opponents of these muscles, club-foot resulted.*



Fig. 363.

There are varieties of *Talipes*.

I. *Talipes Equinus*.—The muscles of the calf are contracted; the tendo Achillis is rigid; the patient steps on the extremities of the metatarsal bones, without bringing the heel to the ground; the foot is in other respects well formed; with the exception of the toes, which are curled up by flexion of the distal and extension of the proximal phalanges. This, as a simple form of *Talipes*, rarely occurs congenitally, but usually appears in childhood during the period of dentition.

II. *Talipes Varus*.—This is the most common variety; consisting of extension, adduction, and rotation of the foot—the rotation being analogous to supination of the hand. The muscles of the calf and the adductors of the foot are contracted; the heel is drawn up; the toes turn

* LITTLE. Introduction, p. 35.

inwards; the outer edge of the foot rests on the ground; and, in progression, weight is borne on the outside of the foot and on the outer ankle—where adventitious bursæ usually form, of some size. The toes



Fig. 364.

are extended. Simple talipes varus rarely occurs; it is usually met with in combination with the Pes Equinus; the affection is then called *Equino-varus*.



Fig. 365.



Fig. 366.

III. *Talipes Valgus*—a rare form—is the reverse of the preceding. There are abduction, rotation, and partial flexion of the foot; the rotation

Fig. 364. Talipes equinus after division of the tendo Achillis.

Fig. 365. Talipes varus.

Fig. 366. The same dissected; shewing the altered relative position of the bones.

being analogous to pronation of the hand. The front of the foot is raised from the ground; and the patient rests on the inside of the instep, and on the inner ankle. The tendons of the peronei muscles are chiefly to blame. This form of club-foot is simulated by "flat-foot," due to yielding and flattening of the tarso-metatarsal arch, especially on the inner side of the foot.

IV. *Talipes Calcaneus*.—The muscles of the calf are paralysed; those in front of the leg are consequently contracted; the foot is extremely flexed; and, in progression, the heel alone touches the ground.

One foot, or both, may be affected by *Talipes*. In the former case, the affected limb is found thinner and more flabby than the other; and, sometimes, by arrest of development, it is shortened as well as weak. The mode of progression is painful and imperfect. And, not unfrequently, contraction takes place at the knee, to a greater or less extent.

Spurious Talipes is said to occur, when displacement of the foot is caused by muscular change or integumental contraction, following on burns, extensive suppurations, ulcers, etc.

Treatment of Talipes.—In the minor cases, which occur in children, mechanical means—early employed, skilfully adapted, and duly persevered with—are, of themselves, sufficient to effect a normal relation of parts. Many such cases occur; and it is quite unnecessary to subject the little patients to the pain of tenotomy. Narrow tin splints, covered with lint or chamois leather, are best for this purpose; and when the condition is that of equino-varus, as is usually the case, the lateral displacement should first be rectified before the heel is brought down. The splints must be changed, at least once in twenty-four hours, to admit of the limbs being washed, to prevent the surface of the skin from becoming excoriated by the bandages and lint being soiled with the urinary secretion, and to avoid the occurrence of ulceration from pressure over the external malleolus. As the foot becomes unbent, and restored more and more nearly to a straight line with the spine of the tibia, the tin splint is curved outwards, so as to overcome to the utmost all tendency to inversion.

When the deformity obviously depends on a paralytic condition of certain muscles—as is more likely to be the case in the acquired than in the congenital examples—attempts may be made to obviate this condition, by remedies directed both to the system and to the part. Attending to the nervous centres, to the chylopoietic viscera, and to the general functions—we may find the symptoms yield, as in the analogous affection of strabismus. And the local means most likely to be of service are—blistering, galvanism, exercise, friction, the endermic use of strychnine, and passive motion.

Tenotomy is had recourse to, when structural shortening of muscle has occurred, when no paralysis is present, and when the obstacles to replacement cannot otherwise be overcome. A large number of cases are so circumstanced. The operations, however, are but part of the remedial means; and will certainly fail, unless suitable apparatus be afterwards employed, well and sedulously. Instead of waiting for reunion of the tendons, and then extending their new bond of union, painfully and

slowly, it is better to effect the required change of relative position soon after section, leaving the hiatus to be filled up by new matter. In the congenital form, the operation should be had recourse to at as early a period as possible. Extreme cases in the elderly adult, on the other hand, should be regarded as irremediable. The form of the bones has in them undergone such change that it is impossible to restore the foot to its normal shape and position. Tenotomy will fail to effect a cure, and may do harm, for a time at least, by impairing very seriously the acquired usefulness of the limbs.

In Talipes Equinus, division of the tendo Achillis is usually sufficient. In the simple form, if the patient can be persuaded to walk about, no apparatus is required for subsequent rectification of the deformity ; and as in this case change in the articulating surfaces of the tibia and astragalus exists to a very limited degree, even in cases of old standing, there is not the same objection to division of the tendo Achillis in adults that exists in the instance of the lateral deformities. In Talipes equino-varus, division of the tendo Achillis may suffice, along with the use of mechanical aid. But, very frequently, it is necessary also to divide the tendons of the tibialis posticus, longus digitorum, and flexor longus pollicis. In confirmed cases, the tibialis anticus and extensor proprius pollicis must be added to the list. By some the tendo Achillis, tibialis anticus, and posticus, are all divided at one operation ; rectification of both the lateral and perpendicular deformation being attempted at once. This, in the slighter forms, may prove effectual ; but, certainly, in a well-marked case, the varus part of the deformity should first be completely overcome, before proceeding to the treatment of the equinus. In Talipes Valgus, the peronei are divided along with the tendo Achillis. In Talipes Calcaneus, the tibialis anticus is cut, along with the extensors of the toes. The results of operative treatment in the two last forms are not usually satisfactory. Fortunately they are of rare and exceptional occurrence.

The tendo Achillis is divided a little above its insertion into the calcaneum. The patient having been placed in a prone position, the limb having been steadied, and the foot having been bent, a tenotomy knife or needle is introduced obliquely ; and, by bringing its edge or point on the rigid tendon, the fibres are cut from without inwards ; an assistant flexing the foot gently, so as to assist in the division. This having been completed, the instrument is withdrawn, and a compress is applied to the aperture. Or division may be reversed ; from within outwards ; but there is thus a risk, with an unsteady patient or untrained assistant, of accidentally wounding the integument. The tibialis posticus may be divided, either above the ankle, or near its insertion in the navicular bone ; in general, the former site is preferred ; at least, when in equino-varus the lateral deformity is first made the subject of operation—for, till the tendo Achillis has been cut as a preliminary measure, it is impossible to develop the tendon of the tibialis posticus below and in front of the internal malleolus, so as to effect its division. As the tendon of the tibialis posticus cannot be felt above the malleolus, its section is effected through a knowledge of its anatomical relation. The posterior margin of the tibia, from half an inch to an inch and a quarter above the internal malleolus having been made out by pressure with the nail, gliding

the skin backwards and forwards, the sharp-pointed tenotomy-knife is entered, with its blade held so as to pass between the tibia and the tendon. Having opened the sheath—and the resistance of the bone on the one side, and of the tendon on the other, having been felt—the edge of the knife is then turned against the latter, with its point inclining outwards. The assistant now everts the foot, so as to oppose the deformity due to inward rotation; and as the operator withdraws the knife with a rapid twitch against the tendon, its section will be both felt and heard. The *tibialis anticus* is divided in front of the ankle, usually from without inwards; but some unnecessarily wary operators advise the performance from within outwards, lest the ankle-joint should suffer. The *flexor longus digitorum* and *longus pollicis* are divided where felt tense in the sole of the foot. Sometimes it is expedient to divide the plantar fascia also. The *peroneus longus* and *peroneus brevis* may be cut through above the external malleolus, or near their points of insertion;—the rest, at such points as circumstances may render apparently the most suitable. As a general rule, in such operations, the knife is moved away from, not towards, arteries and nerves. Its edge, and not its mere point, should be employed in making the section; and should be moved with a steady, sharp incision, as the blade of the knife is withdrawn. Pads of lint are applied over the puncture, and secured by a bandage.*

It is not improbable that, occasionally, reunion of the divided tendon does not take place; but that a new attachment is formed. Obviously, section should be avoided within thecæ; as, in such a locality, there is but little capability of the expected plastic formation.

Many varieties of mechanical apparatus are in use; the simplest usually the best. For the *Talipes Equinus*, and the *Talipes Varus*—the two most common varieties—the indications are simple, and may be simply executed; flexion of the foot, by acting on the ankle; and restoration of the normal position of the foot, as regards rotation and abduction, by acting on the foot itself. In slight cases of *Talipes Equino-varus*, both deformities, viz., of extension and lateral version or rotation, may be rectified at the same time. In more severe examples, the *varus* should first be attended to; and for this purpose, the *tibialis anticus* and *posticus*, and the *flexor longus pollicis*, *longus digitorum*, and the plantar fascia, having been divided, a straight piece of tin or wooden splint, tapering from the knee downwards and extending along the outer side of the leg and foot as far as the extremities of the toes, should be daily applied. The rectification of the deformity is effected in the first instance by the roller bandage, and the arrangement of the padding—of lint or cotton wadding—placed on the splint. When in course of time the spine of the tibia and the first interdigital space are in one straight line, and the foot can easily be everted considerably beyond that point, the heel may be then brought down by section of the *tendo Achillis*. The apparatus employed after this should be made of thin plate iron, covered with woollen padding and chamois leather. It consists of a leg-piece, to which is hinged a wing of thin flexible tin, suited to the outline of the calf, and adapted to afford a more extensive hold to the splint in commanding the foot. The leg splint extends from the head of the tibia

to the sole of the foot. To the outer side of the leg-piece is attached a foot-piece, by means of a steel joint. This steel joint, regulated by two pinch screws, admits of a flexion movement above with the leg-piece, of which the axis corresponds to that of the ankle-joint ; and of a rotation movement below, where it is fixed to the foot-piece. This last part exactly corresponds in outline to the sole of the foot. In application, the foot-piece is first detached from the jointed part, and applied to the sole of the foot, retaining it there by means of a narrow roller. It is again jointed on to the leg splint, which in turn is fastened to the limb by means of the continuation of the same bandage. The degree of flexion and rotation of the ankle and foot is then arranged, and the desired position maintained by tightening up the pinch screws. By the period when the child commences to walk, if friction and galvanism have been diligently employed, the muscles should have become more fully developed, and not shrunken by the use of the apparatus. So soon as the child can support its weight upon its limbs, the splints should be taken off during the day, and applied only during the night ; while friction, shampooing, galvanizing, and cold douching of the legs, should be daily employed. It will be obvious from this description that the operative treatment is in reality a mere adjunct to the use of suitable apparatus, and to the employment of local treatment adapted to the condition of the muscles of the affected limbs. If, then, these essentials are neglected—and they are frequently very irksome to both the little patient and his friends, who should be taught to employ them aright—it need be no wonder that shrunken paralysed legs and feet are so frequently complained of as the price paid for greater symmetry of appearance. Indeed, by some, the results of tenotomy have been regarded as so unsatisfactory that it has either been altogether abandoned by them, or resorted to with depreciatory explanations.

As a means of overcoming these deformities without tenotomy, and at the same time with the view of making the adjusting apparatus of such a kind as shall permit the patient to move about and exercise the limbs, a new method has been recommended by Mr. Barwell. Caoutchouc straps as springs, according to this method, are laid along the surface in the line of the enfeebled muscles and their tendons, and affixed to cutaneous origins and insertions by means of hooks catching on eyelet-holes set in strong adhesive plaster, which is applied longitudinally, circularly, or spirally to the parts. By this method the author represents that he has obtained a large success in the treatment of such deformities ; but it must require a further and more general trial, experimentally, before its superiority to tenotomy and the rigid apparatus properly employed can be admitted.

Flat-foot.

Young adolescents, of delicate health, and exposed to considerable exertion on the feet, are liable to serious lameness from sinking of the arch of the tarsus ; apparently in consequence of relaxation of the connecting ligaments. The arch of the foot is lost, the tibia projects inwards, the foot turns out, the ankle is apt to swell, and progression is

slow, awkward, difficult, and painful. The deformity affects both sexes, and all classes ; excited, in the poor, by overwork ; in the rich, by absurd eversion of the feet, and overtaking of the limbs, in attempts to impart polite accomplishments to these organs. In most cases, a state of system very similar to the strumous will be found. By discontinuance of the exciting causes, by friction, by bandaging and the wearing of a robust plaster on the part, and by general tonic treatment, relief is obtained. It is well also to have the sole of the shoe, or boot, considerably thicker on the inner than on the outer side. And, if matters do not advance favourably, an apparatus may be worn, which will both support the ankle and invert the foot. Sometimes, the young patient, in the process of further development, recovers both symmetry and usefulness.

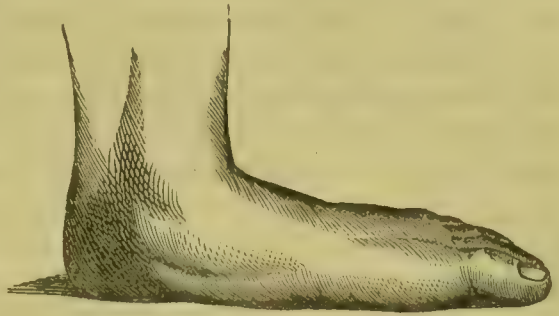


Fig. 367.

In confirmed cases, both deformity and lameness are great. “The peronei and anterior muscles of the foot obtain a preponderance, and eversion of the foot becomes ultimately as considerable as in true Talipes Valgus. The preponderating muscles undergo structural shortening ; the outer margin of the foot, and even sometimes the front of the foot generally, is raised from the ground ; and locomotion is effected to a considerable extent on the heel. The gastrocnemii then waste, and the gait becomes very unsightly.” Such cases are to be treated as examples of Talipes. Tenotomy is required, with the subsequent use of rectifying apparatus. And the tendons which require division are—the tibialis anticus, all the peronei, the extensor proprius pollicis, and the extensor longus digitorum. Such cases occurring in the adult are not very hopeful subjects of treatment, however ; and the division of the whole of the tendons on the dorsal, as well as on the external plantar aspect of the foot, is not likely to make the state of matters much better.

Corns and Bunions.

These painful affections are the result of pressure, exerted by ill-constructed shoes and boots. They are more easily prevented than cured.

1. The shoe or boot should be large enough to contain the foot easily ; and an allowance should be made for the occasional swelling to which the part is liable by exercise, heat, and a dependent position.
2. The sole should be at least as broad as that of the foot. The outline of the foot—represented on a piece of paper, on which the patient leans in the erect posture—should be the measure of the sole of the boot or shoe.
3. The boot or shoe should be square, or, rather, rounded in front ; not sharp, with the point nearly in a central position. The point, corresponding to the end of the great toe, should be nearly in a line with the inside of the instep. And abundance of room should be given for each

Fig. 367. Flat-foot.

toe to occupy its own place, without any crowding, or overlaying of its fellows.

Corns consist of two parts—a thickening of the cuticle; and a hypertrophied and irritable condition of the corresponding papillæ of the true skin. The inflammatory process may supervene. And then a small abscess may form; very painful, because the matter is confined by the dense cuticle; and frequently leading to smart erythema or erysipelas of the foot. Corns are also said to be Soft and Hard. The former situate on the outer points; the latter placed between the toes, where there is naturally considerable moisture. Another division of corns is into the Laminated and Fibrous. In the former, hypertrophied cuticle is arranged in a laminated form; and there is uniform enlargement of the papillæ beneath. In the fibrous, the central papillæ are much enlarged and project; each is surrounded by a sheath of epidermis; and, consequently, while the circumference of the corn is laminated, the central portion presents a fibrous appearance. And, in ordinary language, these projecting papillæ are termed the “roots of the corn.”

The indications of cure are simple. 1. To remove the cause; by wearing suitable boots and shoes, or by leaving the part altogether unfettered for a time. 2. By careful marginal dissection, and enucleation, without, however, wounding the vascular structures of the skin or corn, to remove the hardened and hypertrophied cuticle; and, by repetition, to prevent reproduction. 3. To remove the irritability, and to restore a normal state of the cutis vera; by occasional application of the nitrate of silver. 4. If inflammatory change have occurred, poulticing, fomentation, and rest are suitable. And the subsequently open state of the parts is taken advantage of, so that a free and effectual use of the nitrate may be made. 5. Inveterate cases are palliated, by wearing roomy and soft shoes and boots; also protecting the corns, by means of thick plasters, which are excavated opposite the tender points. And into the excavations, it may be well to insert, occasionally, extract of belladonna, or some other anodyne substance. The soft corn should be treated, when free from fissuring or ulceration, by the application of the strong nitric acid. The cuticle is thus converted into a hard horny pellicle, which in a few days may be removed by scraping. The caustic is then again applied, and the scraping repeated, until pain, produced by the application, indicates that the truly vascular structure of the papillæ has been reached. Glacial acetic acid, and a solution of nitrate of silver (3i. to the 3i.), may be used, but not so efficiently, to attain the same object.

Bunions are formed thus:—1. Inordinate pressure has been habitually made, by boot or shoe, on the ball of the great toe. The skin consequently becomes congested and tender; and the part is red and swollen. This is one form of the affection; remediable by abstraction of the cause, by rest and fomentation, and by a subsequent light use of the nitrate of silver, or of a solution of iodine. 2. Or an adventitious bursa forms over the joint; and enlarges gradually. Occasionally, it may shew an unusual size, by reason of bursitis. The remedies for this form are—abstraction of the cause, discutient applications in the chronic stage, antiphlogistics in the acute. A thin caoutchouc envelope is sometimes of service, by equalizing the pressure of the shoe. 3. Or, in consequence

of repeated attacks of bursitis, the cyst suppurates, and opens externally ; the aperture becomes fistulous ; the cyst contracts, but continues to discharge fluid, more or less ; and acute accessions are ever liable to occur. In this case it is necessary to destroy the cyst, by inserting a piece of potass into the cavity. Afterwards, the granulating sore is brought to heal under the ordinary means—rest, and simple applications. 4. There is an aggravated class of cases, in which there is enlargement of the osseous texture. Blistering and rest may make some favourable impression. By suitable adjustment of the shoe, palliation is obtained. 5. The joint may be partially displaced—in the rheumatic and gouty adult ; the toe riding over its fellows, and pointing to the outer side of the foot. This too, can usually be but palliated. In some cases by wearing capacious soft shoes, and placing a pad of increasing size between the great toe and its fellow, even this deformity and its consequences may be remedied.

Onyxia and Onychia ; Exostosis ; and Contraction of the Toes.

Onyxia and Onychia require the same treatment, as when affecting the fingers. The great toe is the especial site of Onyxia.

Exostosis of the Distal Phalanx of the Great Toe is a troublesome affection, not unfrequent in occurrence. Sometimes the growth takes place from the plantar aspect of the phalanx ; but much more frequently from the dorsal ; elevating the nail, causing pain, and seriously interfering

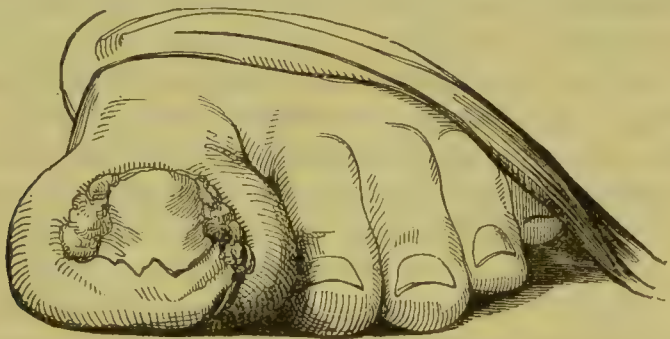


Fig. 368.

with progression. Excision is performed, by means of a strong Wharcliffe knife, or by cutting-pliers ; and, should any reproduction threaten, during cure of the remaining wound, the chloride of zinc is applied.

Contraction of the Toes.—The toes—more especially the one next the great toe—are liable to extreme contraction, whereby considerable deformity is produced, the wearing of boots and shoes is rendered painful, and the functions of the foot are interfered with. Subcutaneous section of the extensor and flexor tendons usually permits sufficient restoration of the normal position. But it is not uncommon to find amputation of the offending toe expedient ; other means having proved unavailing, and the patient being himself anxious for a summary procedure ; this is more particularly the case, when a bursa has formed over the prominent knuckle, and when suppuration with erythema follows even moderate exercise.

Fig. 368. Onyxia ; affecting the great toe.

CHAPTER LXIX.

AMPUTATION.

THE removal of a limb, or part of a limb, is the last resource of our art; and ought never to be had recourse to, until it is evident that other means either have proved, or must prove, unavailing. The profession have reason to rejoice that necessities for the performance of amputation are much less frequent than in former times; yet the circumstances are not few—and in all human probability never will be few—in which nothing but the sacrifice of a part of the body will suffice for the retaining of existence. We are constrained to resort to amputation of a limb; in spreading gangrene, as speedily as possible, if the cause be a local one, if there be a sound space in which to make our incisions, and if the constitution be as yet uninvolved in other than the inflammatory process; in chronic gangrene, when the line of separation has been formed, and is advanced; in tumours which are of a malignant kind, and involve the textures of an extremity so as to preclude the safe and thorough removal of the disease, retaining the limb; in diseases of the joints, which have baffled our skill, have suppurated, and caused urgent hectic, and do not admit of relief by resection; in cases of recent injury, when it is evident that the parts are so far mutilated as to render recovery impossible; and in cases of attempted preservation of limbs, after injury, when it is plain that further continuance of the attempt must be attended with unwarrantable peril of life. Not unfrequently also, a partially recovered limb proves so stiff, useless, and inconvenient, as to urge the possessor to seek its removal; and such operations of “*complaisance*” are not always to be declined.

In the case of injury, amputation is either *primary* or *secondary*; the former, when done within twenty-four hours after the injury, before the condition of shock has been induced, or during its progress, or after reaction has set in, yet before the system has become involved in febrile excitement; the latter, when performed after febrile accession has occurred, and when—it may be after some weeks—life is threatened by excessive suppuration, disease of bone, disease of joints, or sloughing of the soft parts. The comparative merit of primary and secondary amputation is still, with some, a disputed point. The question has already been considered. For its decision, a mere comparison of statistical details is obviously insufficient; for in one class are necessarily included all the most severe cases, while the other contains many of a very minor character; and, in many instances, amputation is primarily performed, not because there is an open question of choice, but because obviously to amputate is to afford the only, and it may be a slender, chance of life.

The two chief objections to the primary operations are :—1. Two

shocks may overpower a patient, who might have rallied successfully from one. To this it is answered, that the operator must choose his time skilfully ; not bringing the two shocks into immediate contact, but waiting until the former has wholly passed away ; and not operating at all, unless a sufficient rally shall have taken place, or the collapse has been obviated by the employment of suitable means, more especially the use of chloroform. It is seldom that a patient perishes of mere sinking, after amputation. And, besides, by the use of chloroform—an agent which is seldom dispensed with in amputations now-a-days—it is to be remembered that the shock is very much modified, and a positive tolerance of the operation seems to be imparted to the system. 2. It is alleged that a robust state of body—in which the patient may be, at the time of the accident—is less favourable to recovery than the comparatively reduced state which obtains after subsidence of the inflammatory fever. This objection obviously can be removed, by judicious antiphlogistic treatment of the case. Not unfrequently, too, inflammatory fever, and its results, afford no opportunity to judge of the expected favourable condition for secondary operation ; the patient dying during the inflammatory period, which is more certain to be severe, destructive, and ill borne in any constitution, when excited by a severe and extensive laceration, than when due to a clean amputation wound.

But we would rather refrain from the discussion in this place ; and simply repeat the practical rule, on which the great majority of surgeons are agreed—That, when an injury has been sustained by a limb, of such a character as to render it impossible, in the opinion of the surgeon, that the part can be retained ; when, in other words, it is obvious that amputation must be performed at some period of the case—it is better to amputate at once, so soon as the system has rallied from the primary shock ; preferring to encounter the minor risk from rapid succession of a second shock, rather than to meet the more perilous invasion of an intense inflammatory range, with its serious consequences to both part and system.

In temporarily restraining hemorrhage, during the incisions, the hands of an assistant are usually preferable to any tourniquet ; as has already been explained. And pressure is not applied until the knife has begun to penetrate ; in order that no unnecessary loss of blood may be occasioned, by venous congestion beneath the site of compression.

Another question, scarcely yet arranged, is, as to the comparative merits of the old circular method of operation, and of the more modern operation by flaps. In this part of the country, the latter, for a long period, has been tacitly preferred ; recourse to the circular method being quite the exception to the general rule of operating. And the obvious advantages are : more rapid performance ; a cleaner cut ; a better immediate covering to the end of the bone ; and a power of selection, as to what parts shall constitute the covering. The vessels are cut obliquely, no doubt ; but, if the ligatures be applied carefully—as they always ought to be—there is no risk of secondary bleeding on this account.

The *Circular amputation* is conducted as follows :—The patient is arranged comfortably recumbent, on a firm table, of convenient height for the operator ; who places himself on the left of the patient, so that

his right hand may be used, freely, for the incisions. The sound limb is held steady, and out of the way, by an assistant ; or is secured by a towel—in the case of the lower limbs—to a leg of the table. Ordinary assistants are ready to control the motions of the patient, to reassure him, if need be, and to minister to his wants. An experienced administrator undertakes the whole charge of the chloroform, from the beginning to the end of the operation ; never allowing himself to be distracted by the details of this from a close and uninterrupted watching of the patient. A trustworthy assistant is ready to command the hemorrhage, by the pressure of his own fingers, or by that of a tourniquet. Another is prepared to retract the flaps, and to tie the arteries. A third is stationed to hand what things may be required ; and these are suitably arranged on an adjoining table—tourniquet, bandage, lint, ligatures, sutures, knives, saw, cutting-pliers, artery-forceps, sponges, chloroform.

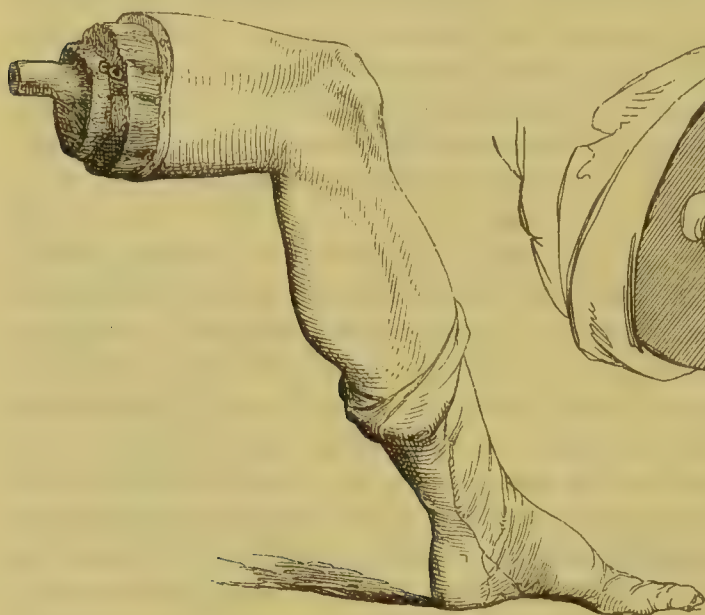


Fig. 369.

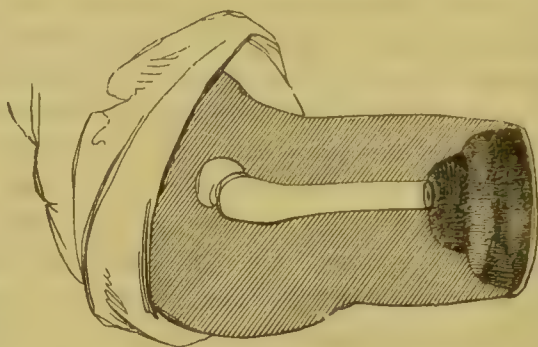


Fig. 370.

If necessary, an assistant, seated in front of the patient, steadies and supports the limb to be removed.

Supposing the thigh to be the part concerned, an assistant, grasping the limb with both his hands, draws up the skin as far as possible. The surgeon, holding the knife lightly, and with his forearm at first carried fairly beneath the thigh, divides the skin and areolar tissue in one continuous sweep. The assistant now retracts the skin, more decidedly than before ; and he is assisted in this, by the surgeon touching the subcutaneous tissues at various points with the point of the instrument. Close to the completely retracted integument, the knife is again laid on ; and, by a second sweep, the superficial muscles are divided. These are pulled upwards by a retractor—a portion of linen or leather, slit at one end ; and, by a third sweep of the knife, laid on

Fig. 369. Circular amputation, illustrated in the thigh. The terraced arrangement of the wound shewn in the amputated part.

Fig. 370. The corresponding stump ; intended to exhibit the comparatively large extent of wound that remains ; in contradistinction to Fig. 372.

close to the retractor, the bone is made bare. Retraction is then applied to all the fleshy textures ; touches of the blade assisting to expose the bone at a higher point ; and, this having been reached, complete isolation of the bone is effected there. The saw is applied, while by the retractor the muscles are protected from injury.

Held perpendicularly, it is "grooved" by drawing it lightly from heel to point. By steady sweeps, section is effected ; the surgeon, meanwhile, controlling the lower limb with his left hand ; making sure that it is not held too high, so as to lock the saw by shutting it up in its own groove ; and taking equal care to prevent its being too much depressed, so as to favour splintering of the bone when the section is nearly completed. During and after the use of the saw, the assistant takes care to apply no traction to the flaps, lest the periosteum be unnecessarily stripped upwards. Should this happen to any considerable extent, necrosis and exfoliation may scarcely fail to ensue. Should any roughness remain on the end of the bone—either by splintering, or from natural construction—this is to be removed by means of the cutting-pliers.

Attention is now immediately directed to the arteries ; the largest being the first secured. Each is laid hold of with the artery-forceps, and, by being pulled outwards, is separated from all surrounding textures ; partly to ensure deligation of the arterial coats only ; partly to secure application of the ligature beyond the oblique section of the vessel. By neglect of this, nerve and vein may be unnecessarily injured ; and the ligature's noose, traversing an oblique section, not going beyond it, may leave a part of the arterial mouth still open, and ready to afford a troublesome hemorrhage. So soon as the larger arteries have been secured, the assistant relaxes his pressure above, or altogether removes it. The smaller vessels can be quite commanded by the finger points ; and, were the high pressure continued, venous loss of blood must necessarily ensue. Removal of the pressure, above, is usually sufficient to arrest the venous flow. But, should this continue, direct pressure is made ; either by the finger applied to the venous orifices, or by shutting the flaps and pressing them firmly together, for a short time.

Bleeding having been satisfactorily arrested, the soft parts are allowed to fall forwards, the ligatures are carefully kept hanging out, and the cut edges of the skin are arranged so as to make the line of union rectilinear, in either a transverse or perpendicular direction. A sufficient number of silver-wire sutures are then introduced, so as to maintain accurate apposition ; without, however, interfering with the escape of blood, serum, and fibrinous product, which, by collecting within, would disturb the union of the stump. The stump so formed may then be dressed with pads of dry lint, adjusted on each side of the line of incision so as still further to prevent any fluid collecting within ; and a bandage is applied so as to support and compress the cut surfaces into juxtaposition. By some, moist applications are preferred, by means of a piece of wet lint placed on the line of wound. The patient is at once removed to bed ; and an opiate having been administered, he is kept quiet with the view of obtaining sleep. An assistant should generally be left in charge lest after-bleeding come on, so as to be able to employ the necessary measures for

its arrest. The subsequent treatment is conducted according to general principles ; our object usually being to obtain adhesion ; yet, not unfrequently, preferring a moderate suppuration—as when the system has been long previously subjected to copious discharge, the sudden arrest of which might seriously endanger the internal organs.

In the Flap operation various operative proceedings may be adopted, which are slight or important modifications of each other. The following are the most important varieties :—(a.) The flaps are formed by transfixion ; (b.) By cutting from without inwards. (c.) They consist of all the tissues of the limb ; or (d.) of skin and areolar tissue alone. (e.) There may be one flap ; (f.) or two flaps. (g.) The flap or flaps may be either rounded or rectilinear in outline.

Suppose that the thigh is to be amputated by double flaps—the same preliminaries having been arranged as for the circular operation, the surgeon grasps the flesh in front of the limb with his left hand, so as to

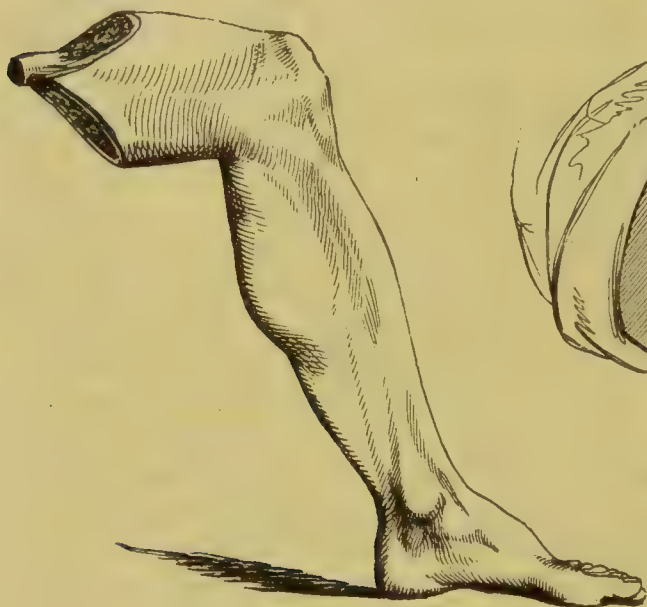


Fig. 371.

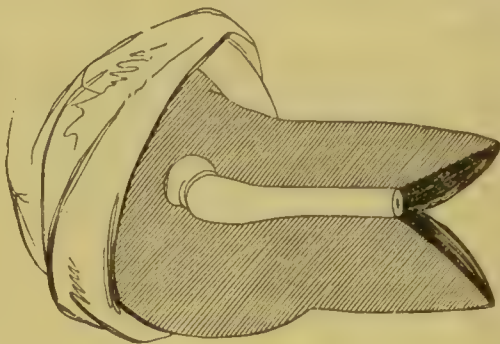


Fig. 372.

raise it from the bone, the assistant at the same time pressing upwards the muscles and other soft parts from behind with the palm of the hand held horizontal ; thereby the making of a full broad anterior flap being secured. As the knife's point is about to enter, pressure is applied to the femoral. Transfixion is made, by pushing the knife down to the centre of the bone, horizontally ; gently passing the point over this to the front ; and then pushing across, so as to make the place of exit as nearly as possible opposite to that of entrance. Moving the knife downwards and outwards, with a gentle sawing motion in long sweeps—cutting chiefly from heel to point—a sufficient flap is formed anteriorly ; and this is raised by the assistant. The knife's point is then re-entered, about an inch beneath the site of the former transfixion,

Fig. 371. The flap-operation illustrated in the thigh. The sloping wounds, whence the flaps have been taken, shewn in the amputated part.

Fig. 372. The corresponding stump ; intended to exhibit the comparatively small extent of wound that remains ; in contradistinction to Fig. 370.

in order to avoid cross-cutting of the integument, which is otherwise apt to occur. And, the second transfixion having been effected, a second flap is formed posteriorly. This is quickly laid hold of by the assistant's other hand; and he now retracts both flaps; pulling steadily; and keeping his own fingers out of the way. The surgeon, by circular sweeps made with the heel of his knife, divides the soft parts completely, as high as the fleshy commissure of the flaps will permit; effecting this leisurely and coolly, in order that it may be done thoroughly. Not even a shred of periosteum should be left at the point which is to be sawn; and this should be as close to the adherent cushion of muscle above as the instrument can be made to go. The form of the wound—the flaps unretracted—is wedge-shaped; and the sawn end of the bone must occupy the very apex of the cone.

The assistant continuing to keep the flaps out of harm's way, the saw is applied to the isolated portion of bone—the side of the instrument lying close upon the fleshy wall above.

The rapidity and brilliancy in execution of the double flap operation by transfixion, as practised by Lisfranc and Liston, commended it no less to the profession than to the public. To the latter, especially before the days of chloroform, rapidity formed a great element in the preference shewn for this mode of procedure. The result, however, of the double flap, formed by transfixion, has not been in all cases uniformly satisfactory; the stump formed by a well-performed circular operation, sometimes forming a more useful covering to the end of the bone. At the same time, the flap operation is certainly an easier method of making a good stump than the circular, in the hands of one unaccustomed to operate. The objections to it are—1st, the great degree of retraction of the muscular elements of the stump, and consequent tendency to protrusion of the end of the bone; and 2d, that in primary operations the mass of muscle is usually so disproportionate to the flaps, that it can with difficulty be contained within them. Attempts have been made to obviate the former evil by cutting both flaps of great length, or by making the one corresponding to the flexor muscles, and thus most likely to contract inordinately, some inches longer than the other. To meet the other disadvantage in primary amputations, the flaps may be formed entirely, or nearly so, of skin and areolar tissue cut from without inwards, and turned up while the muscles are either cut slopingly, or divided circularly. More recently, however, a new method of amputating has been introduced by Mr. Teale, called the plan by rectangular flap. Mr. Teale speaks as follows:—*

“Supposing the amputation to take place at the lower part of the middle third of the thigh, a situation well suited for the adaptation of an artificial leg, the circumference of the limb is to be measured at the point where the bone is to be divided. Assuming this to be sixteen inches, the long flap is to have its length and breadth each equal to half the circumference, namely, eight inches. Two longitudinal lines of this extent are then traced on the limb, and are met at their lower points by a transverse line of the same length. The inner longitudinal line should

* On amputation by a long and short rectangular flap, by Thos. P. Teale, F.R.C.S., Surgeon to the Leeds General Infirmary, 1858.

be first traced in ink as near as practicable to the femoral vessels, without including them within the range of the long flap. The outer longitudinal line, which is somewhat posterior, is next marked, eight inches distant from the former, and parallel to it. These two lines are then

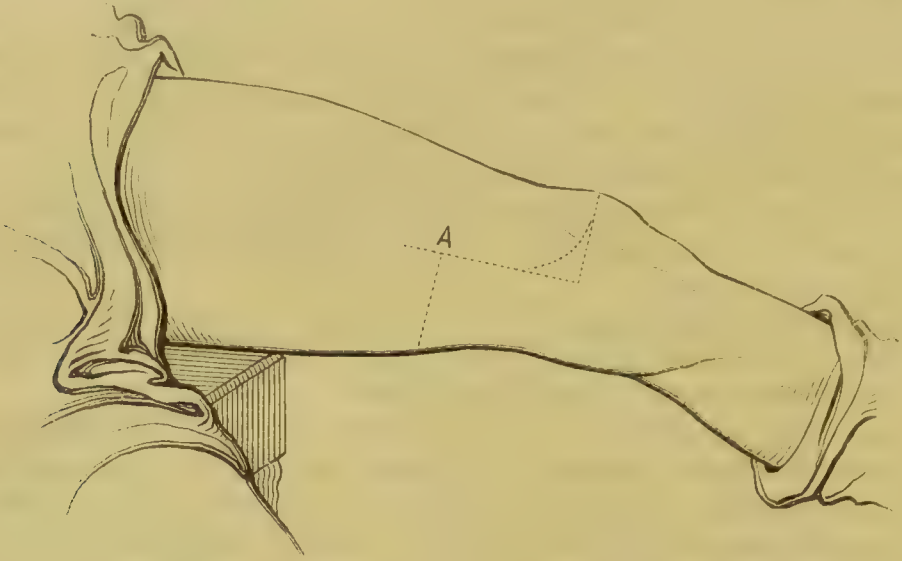


Fig. 373.

joined by a transverse line of the same extent, which falls upon the upper border of the patella, or upon some lower portion of this bone. The short flap is indicated by a transverse line passing behind the thigh, the length of this flap being one-fourth that of the long one ; or, assum-

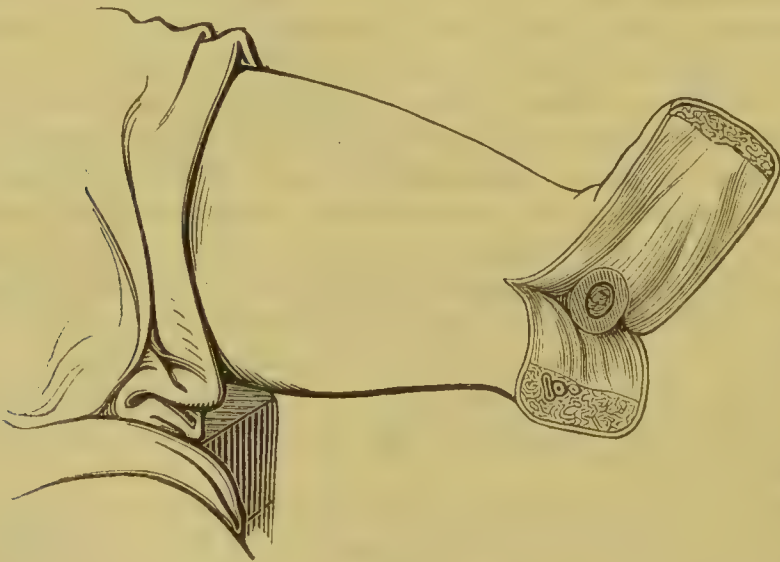


Fig. 374.

ing the circumference of the limb to be sixteen inches, and the length of the long flap eight inches, the length of the short flap is two inches.

Fig. 373. Lines of incision for Teale's amputation in the lower third of the thigh, by the rectangular method, and its circular modification. In the latter, the incisions go no higher than A.

Fig. 374. Flaps as formed by Teale's method.

"The operator begins by making the two lateral incisions of the long flap through the *integuments only*. The transverse incision of this flap, supposing it to run along the upper edge of the patella, is made by a free sweep of the knife through the skin and tendinous structures down to the femur. Should the lower transverse line of the flap fall across the middle or lower part of the patella, the transverse incision can extend through the skin only, which must be dissected up as far as the upper border of the patella, at which place the tendinous structures are to be cut direct to the thigh-bone. The flap is completed by cutting the fleshy structures from below upwards close to the bone. The posterior short flap, containing the large vessels and nerves, is made by *one sweep* of the knife down to the bone, the soft parts being afterwards separated from the bone close to the periosteum, as far upwards as the intended place of sawing.

"The arteries being secured, the flaps may be united by suture immediately; or they may be lightly placed in apposition, the stump being wrapped in a fold of napkin for four or six hours, when any clotted blood may be gently removed by a sponge, and the flaps finally adjusted. I prefer the latter method, as we thereby avoid the evil of infiltration of the tissues of the stump with blood, which often is the cause of suppuration in these parts.

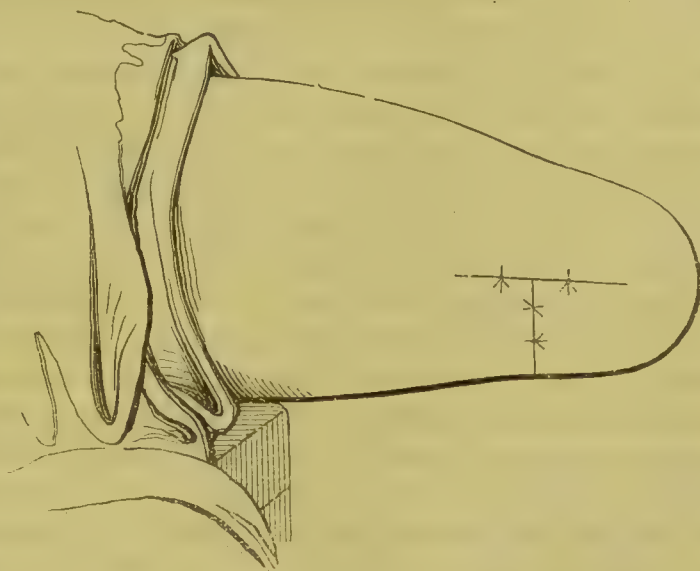


Fig. 375.

"In adjusting the flaps, the long one is folded over the end of the bone, and brought, by its transverse line, into union with the short flap, the two corresponding free angles of each being first united by suture. One or two additional stitches complete the transverse line of union. As the long flap is folded upon itself so as to form a kind of pouch for the end of the bone, it is requisite that it should be held in its folded state by a point of suture on each side. Another stitch on each side secures the lateral line of the short flap to the corresponding part of the long one. A longitudinal line of union thus passes at right angles each end of the transverse line. The position of the longitudinal line at each end of the transverse one will be rendered more easily intelligible by reference to the accompanying diagram."

This somewhat complicated procedure Mr. Teale proposes to extend to amputation of the leg, arm, forearm, and even of the fingers. The great length of anterior flap, no doubt, admits of some portion of the patient's weight being borne by the thick musculo-cutaneous cushion which covers the end of the bone, instead of being diffused generally over the whole

Fig. 375. Teale's operation completed.

cutaneous surface, or pressing excessively and painfully upon neighbouring osseous prominences, as in the old method. There are, however, many cases of injury in which such a long flap cannot be obtained, without dividing the bone at an unnecessarily high point. To obviate this objection, and to facilitate the operative manipulations, two methods have of late been extensively practised. One (Alanson and Spence) consists in the formation of a single long anterior flap, with a rounded outline. This is formed principally of skin and areolar tissue, but contains also the mass of muscles obliquely divided towards the bone. The textures upon the posterior aspect are cut through with a sweep of the knife upon the level to which the anterior flap has been raised. The whole of the soft parts are then firmly retracted, and the bone cut through as high as exposed. The vessels having been tied, the front flap falls over the end of the bone, and covers in the mass of muscles posteriorly. The result is, in regard to appearance and ability to support the patient's weight, quite as satisfactory as by Mr. Teale's plan. The second method (Alanson and Syme), tending to keep the cutaneous cicatrix free from the end of the bone, is well suited for primary amputation; as it affords an ample covering, without dividing the bone at an unnecessarily high level. Two areolo-cutaneous flaps are formed; the larger in front, in length about two-thirds of the diameter of the limb; the shorter behind, and intended only to meet and adapt itself to the anterior; its length, therefore, should be about one-half of the anterior, or one-third of the diameter of the limb. In the thigh, the anterior flap should contain, except at its margin, a good deal of the muscular tissue of the quadriceps extensor cruris; the posterior, on the contrary, should contain no muscle; and to prevent its being carried upwards by the contraction of the powerful flexor muscles of the knee, the areolo-cutaneous flap should be dissected up to its angle of junction with the anterior before the muscles are divided. The muscles in front tend to maintain the vascular supply of the anterior flap, besides forming a thick firm cushion, covering in the end of the bone. These last-described methods—of chiefest importance in amputations low down in the thigh and arm, especially of a primary kind—are least necessary when, from long-standing disease, the tendency to retraction is much diminished, partly by cohesion of the soft parts to each other and to the bone, and also from the muscles having undergone fatty transformation.

Amputation of the Fingers.

Amputation at the Distal and Middle Joints is performed thus:—An assistant controls bleeding, by grasping the wrist tightly. Another separates the fingers from that which is to be removed; at the same time steadying the hand in a pronated position. The surgeon lays hold of the finger, slightly bending the joint at which removal is to take place; and the articulation is then laid open, by a sweep of a narrow straight bistoury. Division of the lateral ligaments is completed, if need be, by the point of the instrument; and the joint is more flexed, to favour disarticulation. This having been effected, the knife's blade is placed behind the head of the bone; and by cutting

downwards and outwards, a sufficient flap is formed on the palmar aspect. Previously to disarticulation, the surgeon lays hold of the part on its dorsal and palmar aspects ; in making the flap, his hold is lateral. Or the procedure may be reversed. The hand being placed in a state of supination, transfixion is made in front of the joint ; by cutting downwards and outwards, the flap is made in the first instance ; and then, by a sweep of the knife, disarticulation is effected, and the integuments on the dorsal aspect are divided. Usually, no hemostatics are required. The flap is turned over the joint, and is retained in its place by a single point of suture, or by bandage or strap alone. Such amputations are, however, rarely required ; the conditions demanding operative interference in the fingers being usually of such a kind as either necessitate amputation of the whole finger, or are better remedied by cutting two rounded flaps from without inwards—the one upon the flexor, the other upon the extensor aspect—and dividing the bone

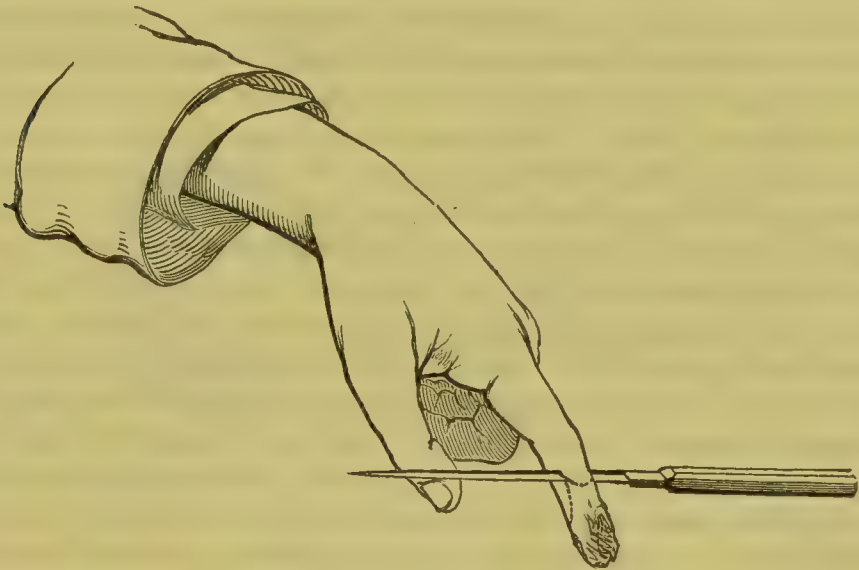


Fig. 376.

with pliers. In using this instrument care is taken to place its smooth side always where the stump is to be ; otherwise splintering and irregularity are apt to occur, and to be followed by necrosis. In the middle, ring, and little fingers, amputation through the middle phalanx should not as a rule be preferred to amputation of the whole digit ; as half a finger among the others has a very unseemly appearance, and does not afford a commensurately increased degree of usefulness to the hand. An exception to this rule, however, should be made in cases of injury involving all the fingers ; as in such circumstances any portion, however small, more particularly of the fingers towards the volar aspect of the hand, should be retained.

The Proximal phalanx, if not wholly involved in injury or disease, should not be entirely sacrificed in the case of working men, when the forefinger is the injured digit, or when the other fingers upon the radial side of the partially injured one have required complete amputation. When the operation is required, it may be performed according to any

Fig. 376. Amputation of the finger, at the distal articulation.

of the methods just described. Hemorrhage having been arrested, the flaps are united and retained in the ordinary way.

Amputation at the Metacarpal Joint may be performed in various ways. In all, the hand is held pronated. 1. The finger, well separated from its fellows, is laid hold of by the surgeon, and drawn to one side. On the exposed and tense web, the bistoury is passed upwards, from point to heel, so as to expose that side of the articulation ; at the same time, leaving on its outer side a suitable proportion of soft parts. With the knife's point, disarticulation is effected ; the finger being pushed much across to facilitate the process. Were the blade to be used for this purpose, ragged wounding of the integument could not well be avoided. The head of the bone having been detached, the blade of the knife is placed behind it ; and, by cutting obliquely outwards through the other web, detachment of the finger is completed, and a second cut surface is formed, to suit the former. This method, however, interferes with the soft parts in the palm of the hand, and has therefore no advantage, except rapidity of execution, to recommend it. 2. Or the knife's point is entered on the centre of the knuckle ; and is carried either round the finger, by one continuous movement, so as to make two equal, lateral, semilunar flaps, at the same time exposing the joint—or the surgeon makes one incision through the skin and areolar tissue, from the prominence of the knuckle to a point just short of the centre of the free edge of the web. The knife is then carried inwards to the centre of the fold between the finger and the palm. A corresponding incision is made upon the other side. Disarticulation is then effected ; dividing the flexor tendons with the point of the knife as a preliminary ; and in removing the fingers, keeping as close to the phalanx as possible, so as to dissect it out of the soft parts. The two digital arteries usually require ligature. Approximation is effected by bringing the adjoining fingers together, and retaining them by means of a slip of bandage. Cold pledgets of lint are applied ; and, otherwise, the wound is managed in the ordinary way.

When operating on the fore and little fingers, it is often more satisfactory to make the line of cicatrix lateral, instead of antero-posterior. To effect this, the radial or ulnar margin of the hand is held towards the surgeon, while the other fingers are kept out of the way by an assistant, who may also steady the wrist, and by his gripe control the circulation during the operation. The surgeon now enters his knife at the centre of the free margin of the web, and carries it outwards along the line of flexure of the finger upon the palm, terminating the wound either over the head of the metacarpal bone, or, when this is to be removed, at a point three-quarters of an inch further back. A similar incision is made upon the dorsum of the finger, and disarticulation effected from the palmar aspect. It is usually well to extend the incision three-quarters of an inch behind the articulation, so as to expose the head of the metacarpal bone, and to effect removal of its prominent articulating surface by means of the cutting-pliers. The stump is less angular, and has a more seemly appearance after cicatrization, than when the end of the metacarpal bone is left projecting. In doing this, care must be taken not to injure the transverse ligament.

In removing two or more fingers at the metacarpo-phalangeal articulation, one incision should correspond to the line of flexure of the fingers upon the palm, and the dorsal should extend equally far forwards, and cross about the middle of the proximal phalanx. Disarticulation is readily effected from the palm after dividing the flexor tendons, and the heads of the bones are separately or collectively dissected out of the posterior flap. If all the fingers require to be amputated at once, the palmar flap may be formed by transfixion; disarticulation effected, the knife is applied behind the phalanges and carried outwards and backwards.

Amputation of the Metacarpal Bones along with the fingers, in whole or in part, is sometimes required; in consequence of disease affecting one or more of them. The incisions vary, necessarily, according to the extent of the disease, and the site of the openings already existing; but should always be made upon the dorsum of the hand, except in the case of the fore and little fingers when the mere head of the metacarpal bone requires removal. In such circumstances the plan of operation just described should be adopted. When the palm of the hand is lacerated,



Fig. 377.

along with injury to the metacarpal bones, the incision may, of course, include all the torn parts in that situation.

In disarticulating either or both of the two central metacarpal bones from the carpus, the incision upon the dorsum should be carried beyond the head of the metacarpal bone; and, bearing in mind the undulating line of the articulations, the operator should divide the dorsal ligaments; the metacarpal bone is at the same time forced forwards into the palm; and the point of the knife, with its edge backwards, inserted into the interosseous space on each side, is carried backwards, so as to divide the lateral attachments of the metacarpal bone.

Amputation of the Metacarpal Bone of the Little Finger may be accomplished thus:—The finger is laid hold of, and separated from the others; and the bistoury, laid on the stretched web, is carried up at once, along the inside of the metacarpal bone, to its articulation with the unciform bone of the carpus. The doomed part being pushed out-

Fig. 377. Stump of the hand, in which only the thumb and little finger, with their metacarpal bones, were left; after amputation on account of injury by a printing machine. The thumb and finger acquired great mobility and power, and the stump proved most serviceable.

wards, disarticulation is effected with the point of the knife. And then, the blade having been placed behind the base of the bone, a suitable flap is formed on the outer side, by bringing the blade downwards and outwards, till it emerges a little below the metacarpal articulation. Hemorrhage having been arrested, the flap is accurately adjusted to the raw metacarpal surface, and retained in the usual way.

Or the flap may be made in the first instance ; by transfixing at the carpal articulation, and carrying the knife downwards and outwards, as before ; or by marking out the flap with the knife's point, and dissecting it up—cutting from without inwards. The great objections to this plan of operation are, first, the interference it necessitates with the soft parts of the palm ; and, second, the risk of sloughing of the narrow flap, so formed, which possesses little else than a cutaneous connection at its base.

The fingers are taken with the metacarpal bones ; for the former become useless appendages, when deprived of their support. If in amputating a finger and its metacarpal bone, the corresponding carpal surface be found in a carious state, the diseased parts may be removed by means of a gouge ; and the progress of cure may prove most satisfactory.

Disease or injury of all the metacarpal bones of the fingers, so long as the thumb is intact and a sufficiency of soft parts remain to form a stump, does not warrant removal of the whole hand. The result from amputation of the affected parts only, even when a thumb alone remains, is infinitely more serviceable than that which follows complete mutilation ; and when a portion of one finger—it makes no matter which—with its metacarpal bone, is preserved, the claw-like member is capable of an education for various occupations, requiring the greatest skill and accuracy of manipulation.

When the distal part, only, of a metacarpal bone is affected, disarticulation at the carpus is not necessary ; but section of the bone is made in its shaft, by means of the cutting-pliers. The knife is entered on the dorsal aspect, at the point where section is to be made, and is carried down obliquely on either side, as in amputation of the finger only ; but without passing the knife so deeply as to open the articulation. Then, by dissection, the diseased portion of the bone is isolated ; care being taken to leave the palm entire.

Amputation of the Thumb.

The phalanges of the thumb are removed in the same way as the phalanges of the fingers. But every effort should be made to avoid the necessity of resorting to such an operation.

Amputation of the Phalanges, with the Metacarpal Bone, may be effected in the same way as removal of the forefinger and its metacarpal bone, or according to the second method for amputating the little finger and its metacarpal bone. In the execution of the former method, the fingers having been held out of the way, the surgeon, controlling the thumb, enters his knife in the middle of the web extending between it and the forefinger. He then sweeps the blade downwards in a slightly curvilinear direction—first on the extensor, then on the flexor aspect of the

hand—to the head of the metacarpal bone at its articulation with the trapezium. Still further abducting the member, he severs the volar mass of muscles from the palm, divides the flexor tendon, and completes the operation by disarticulation. Or the bistoury may be entered over the trapezium, and carried down on the dorsum of the metacarpal bone; having reached the distal extremity of this, it may be swerved to the inside; thence it may be made to transfix the ball of the thumb, emerging where it first entered; and, by cutting outwards and downwards, the flap may be constructed. According to the other method, by placing the bistoury on the web between the thumb and forefinger, and passing it up to the articulation with the trapezium, the surgeon effects disarticulation there, and laying the blade behind the metacarpal bone, forms a suitable flap by bringing the knife down on the outer side. Or, transfixing at the articulation with the trapezium, he makes the flap in the first instance; afterwards effecting disarticulation, isolating the bone, and removing the member. Or the flap may be made by dissection upwards.

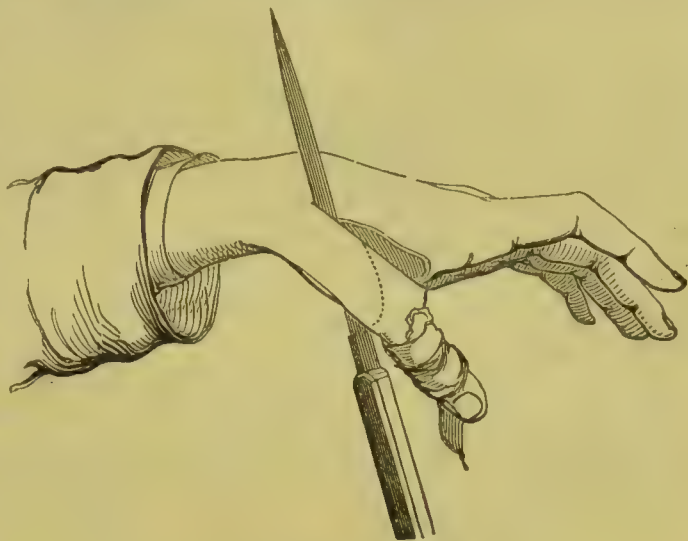


Fig. 378.

Excision of the Metacarpal Bone of the Thumb in cases of disease may be practised by a straight incision made along the dorsum. The result has in several cases justified the adoption of this procedure, by affording a more useful hand than had the thumb been removed entire;* a conclusion opposed to what obtains in regard to the fingers similarly circumstanced.

Amputation of the Wrist.

Hitherto, pressure on the wrist has sufficed temporarily to restrain hemorrhage. Now, compression of the brachial is expedient; and is best effected by the firm and steady grasp of an assistant—on the lower part of the arm—the nerves being excluded from pressure as much as possible.

Hitherto, also, a narrow, straight, sharp-pointed bistoury has been the preferable instrument for making the incisions. Now, a regular amputating knife is required: an exaggeration of the former instrument, in a fixed wooden handle; straight, sharp-pointed, and of fine edge and temper; light yet firm. The amputating case contains various sizes; proportioned to the dimensions of the parts which may require their use.

* SYME, *Observations in Clinical Surgery*, p. 38.

For the wrist, the shortest size will suffice ; the blade not much larger than that of a full-sized bistoury. The arm is steadied, with the hand in a state of pronation. The knife is laid on below the styloid process furthest from the operator—who stands on the patient's left—and is carried across the limb so as to form a semilunar wound on the dorsal aspect, whose centre extends as far as the second carpal range, and whose termination is below the styloid process on the side next the surgeon. An assistant retracts the flap thus formed. The wrist is bent, and disarticulation effected ; the fact of the semilunar line of articulation looking forwards being borne in mind in effecting this manipulation. The blade of the knife is



Fig. 379.

then laid in front of the carpus ; and, by cutting outwards and downwards, a suitable flap is formed on the palmar aspect. In the last part of the proceeding, the pisiform bone is to be avoided ; and, in endeavouring to escape from it, care must be taken not to notch the corresponding portion of integument. To avoid this more thoroughly, and retain as thick a cushion of soft parts as possible, the flap from the palm may be mapped out by cutting through the tissues of the palm from without inwards, and effecting disarticulation last of all. The radial, ulnar, and interosseous arteries, require ligature. The only case, however, in which this amputation should be preferred to the more common one in the middle of the forearm, is that of injury to the metacarpal region of the hand, from the bursting of a gun, or from a charge of shot passing though the hand—and where the surgeon has no saw within reach to enable him to perform the operation in the continuity of the limb. The advantages claimed for the operation consist in the long stump and the retention of pronation and supination. These advantages, however, are found to exist only in theory ; for the radio-ulnar articulation, suppurating during cicatrization of the stump, becomes ankylosed, while the long stump forms an impediment to the adaptation of every form of apparatus. Besides, suppuration along the tendinous sheaths, and among the muscles of the forearm, is liable to occur.

Amputation of the Forearm.

Pressure being made on the brachial artery by means of a tourniquet, or on the lower third of the axillary by manual compression, the limb is steadied, with the hand in a state of pronation. Two flaps are formed ; one on the dorsal, the other on the palmar aspect. Below the

Fig. 379. Amputation of the wrist.

middle of the forearm, it is not easy to obtain a sufficiency of fleshy covering for an operation by transfixion. Yet—when circumstances admit of it—the amputation may easily enough be performed there, by cutting from without inwards, and retaining nothing but skin and areolar tissue to constitute the flaps.

The flaps, then, may be made either by transfixion, or by cutting from without inwards ; or by a combination of the two modes, the dorsal flap being made by dissection, the flexor by transfixion. Operating by transfixion, in the case of the left forearm, the surgeon with his left hand pinches up the cutaneous tissues on the dorsal aspect, and enters his knife horizontally over the ulna, bringing it out at a corresponding point over the radius, and making the flap, deliberately. The knife is again introduced, beneath the ulna, and pushed through on the palmar aspect of the bones ; not at the same point as the former transfixion, but about half an inch lower down ; while the assistant, holding the limb,

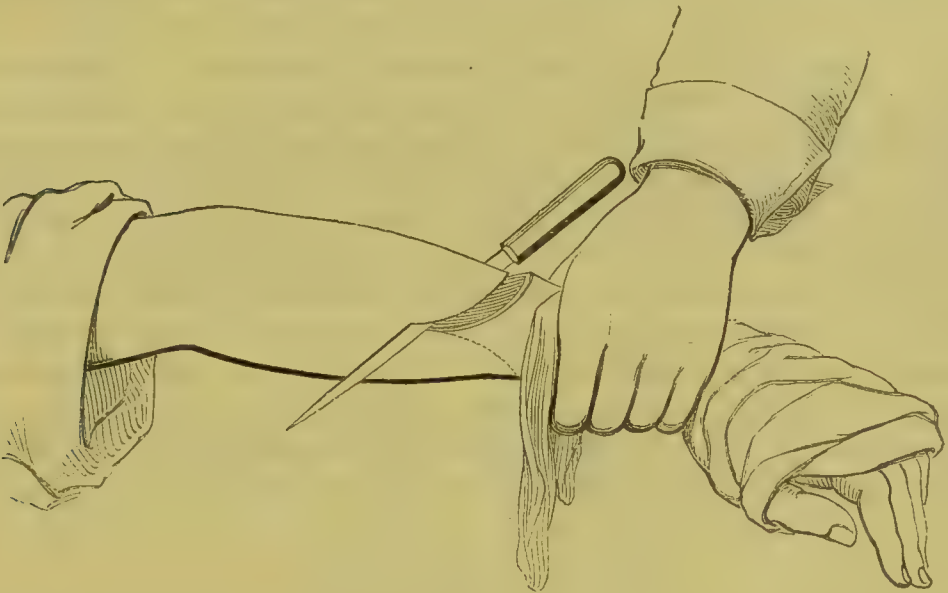


Fig. 380.

extends the hand and fingers that the muscles may be cut short, and redundancy of muscle or tendon in the flap avoided. An assistant retracts the flaps ; with a few circular sweeps of the knife the surgeon clears the bone of soft parts, at the very upper part of the wound ; the interosseous space is freed, by the knife being passed between the bones ; and the saw is then applied. The three principal vessels, at least, require ligature. The wound is then adjusted in the ordinary way.

In most cases, it is easier of execution to make the posterior flap by external incision and dissection ; and, especially in primary amputations, to employ it as the principal covering for the bones ; cutting it, therefore, long and broad ; and dividing the soft parts upon the flexor aspect, either by transfixion, or by cutting from without inwards, so as to leave as little muscle as possible in the composition of the stump. This procedure will be found to afford every advantage possessed by Mr. Teale's method, and to have the additional recommendation of being more easily performed, as well as better suited than the rectangular flap for the dimi-

Fig. 380. Amputation of forearm.

nishing conical form of the forearm. The ulnar and median nerve should always be cut short, so as to avoid pain during the suppuration of the stump, and the formation of neuromata afterwards. In clearing the bones, the knife should not be directed obliquely upwards, as the interosseous artery may thus be divided higher than the general surface of the stump, and give considerable trouble in applying the ligature.

In transfixion, it is obvious that care must be taken to avoid passing the knife between the bones. On this account, the position of the limb here recommended is preferable to the middle state between pronation and supination ; and during the incisions, care must be taken that the position is maintained unaltered.

Amputation at the Elbow-Joint.

If space enough be left on the forearm, in extensive disease or injury of that part, the humerus need not be interfered with. An excellent operation may be done at the elbow ; making a single flap in front. The limb is steadied, with the hand in a state of supination. Transfixion is made, by passing the knife over the condyles, in front of the joint ; and, by cutting downwards and outwards, a large and suitable flap is constructed. With a circular sweep, the integuments behind are divided ; and disarticulation is then effected by a few touches of the point of the knife. In opening the articulation from the front, the lower level of the inner or trochlear side of the humerus should be borne in mind, rendering the line of articulation oblique and not transverse. Some recommend that the olecranon should be sawn across ; but this seems quite unnecessary ; for, by extending the forearm, the process may be easily dissected out of the soft parts, the attachment of the triceps having been severed. The flap is then suitably adjusted over the trochlea of the humerus.

Amputation of the Arm.

This situation is admirably adapted for the flap amputation by transfixion, owing to the equable manner in which the bone is surrounded by soft parts. The method by circular incision, by short areolo-cutaneous flaps, or by the long external rounded or rectangular flaps, may all be easily performed, and will afford excellent results. Cases of injury afford usually the best opportunity for making a selection of procedure ; for in chronic disease the facility of the operation by transfixion will give it the preference over any other method.

Pressure is made on the upper part of the humeral—or, to afford the surgeon and his assistant as much space as possible, on the lower third of the axillary artery. This latter situation affords the further advantage, that the vessel is more easily controlled, being less liable to roll away from under the fingers. The surgeon with his left hand steadies the limb, below the point of incision ; while an assistant, seated in front of the patient, supports the hand and forearm. The knife is entered horizontally over the bone near its centre, on the side of the limb nearest the surgeon ; the point having almost touched the bone, is passed lightly round to its external surface, by depression of the handle ; then the

handle is raised again to its former level, and transfixion is completed. By cutting downwards and outwards, an external flap is formed. The knife is re-entered on the opposite aspect of the bone, a little lower

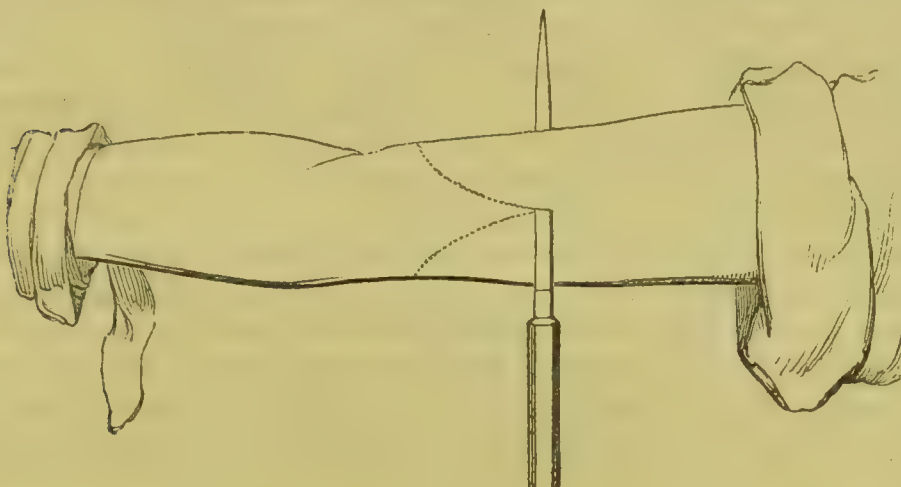


Fig. 381.

down ; and, after transfixion, is brought out so as to construct a corresponding flap internally. The flaps having been retracted, the bone is bared, and the saw applied. The flaps may be made antero-posterior, if that direction affords any advantage.

Amputation at the Shoulder-Joint.

Hemorrhage may be restrained during this operation by pressure applied to the subclavian, above the clavicle ; by the finger alone ; or by means of the handle of a key, well padded ; or by means of any other suitable compressing agent. But this is hardly necessary ; as the fingers of the assistant, following the back of the knife, seize the vessels in the axillary flap as they are cut at the last stage of the operation. If the subclavian is to be compressed, the pressure must not be made downwards merely ; but downwards and backwards, so as to jam the vessel between the compressing agent and the first rib. The patient may be either seated or recumbent. The former position is the more convenient for the operator, as well as for the compressor ; but, if it be adopted, it is necessary to secure the patient against changing his position, through fainting or restlessness, by lashing him to the back of a chair by means of a sheet or towel, as well as by a suitable arrangement of supporting assistants. And now that chloroform is almost invariably employed, this posture is generally superseded by that of recumbency. In cases of injury, the selection of flaps, as to position and form, may not be left to the surgeon's choice ; but may have been already indicated by the nature of the accident. When space and opportunity for selection are afforded, however, the operation may be accomplished in a variety of ways.

The method by transfixion, and by the formation of an outer and inner flap, is generally preferred and practised where the method of operat-

Fig. 381. Amputation of the arm.

ing is in the option of the surgeon. The steps of the procedure vary according to the limb operated on. In the *right* shoulder, it is effected thus :—The arm having been abducted from the side and carried a little forwards, a long knife is entered in the triangular space between the coracoid, acromion, and the clavicle ; and, passing round the head of the humerus beneath the acromion, is brought out immediately within the posterior border of the axilla. By cutting outwards and downwards, a large outer flap is formed. The arm is then carried across the chest ; and the head of the bone, thus made prominent, if not already liberated from the capsule by the passage of the knife in transfixion (Lisfranc), is exposed by a sweep of the instrument which opens the capsule throughout the whole extent of the wound (Dupuytren). Disarticulation is then effected ; and the blade of the knife, laid on the inside of the head of the bone, is carried rapidly inwards and downwards, so as to form an internal flap, considerably smaller than the other. The main artery, seized in the flap by the fingers of an assistant following the movements of the operator,



Fig. 382.

is immediately secured by ligature ; and then pressure on the subclavian, should it have been employed, is removed, lest, by its continuance, venous hemorrhage should be favoured. In making this transfixion thrust, the knife requires careful management ; to avoid, on the one hand, catching its point upon the head of the humerus, or on the under surface of the acromion, and, on the other, cross-cutting of the skin at the point of entrance. The latter risk is best avoided by turning the edge of the knife towards the humerus, at the same time that the point is depressed for the purpose of bringing it out within the axillary margin.

On the *left* side, the arm having been abducted and brought a little forwards, the knife is entered within the margin of the posterior border of the axilla, and made to emerge above and in front of the head of the humerus, in the same triangular space, between the coracoid, clavicle, and acromion, as the transfixion thrust commenced upon the right side. The outer flap is formed as before. The arm is then carried over the chest, disarticulation effected, and another flap formed. In effecting

Fig. 382. Amputation at the shoulder, left side, by Lisfranc's method.

the transfixion, the same care and attention are required to avoid locking the knife, or cross-cutting the skin. This is managed by inclining the knife's edge toward the bone, and away from the skin of the posterior flap, as the point is thrust beneath the acromion. The point of the knife should, furthermore, cut its way round the head of the bone, before the heel of the blade is permitted to commence the sweeping incision which completes the flap.

In some cases, the operation is performed otherwise; the surgeon transfixes transversely the deltoid muscle, immediately below the acromion; having cut a large external flap, disarticulation is effected; and the textures on the axillary aspect of the humerus are divided—not directly below the acromion, but at a point corresponding to the insertion of the muscles forming the anterior and posterior folds of the axilla.

In cases of injury requiring amputation at the shoulder, often none of these methods will suit the exigencies of the case; all leverage power controlling the head of the bone being lost by the fracture or comminution of the shaft and neck of the humerus. In such circumstances, Larrey's method should be preferred. In it the limb is removed by two curvilinear incisions; one on the anterior, the other on the posterior aspect of the shoulder; commencing above, at the acromion, and terminating beneath, either by a continuous straight line of incision across the floor of the axilla, or by the anterior incision being prolonged from the margin of the pectoral, where it ends, to meet the termination of the posterior at the border of the latissimus dorsi muscle. In performing this operation, a short six-inch amputating knife is most convenient. The operator thrusts its point perpendicularly inwards, beneath the acromion; and cuts downwards, parallel to the fibres of the deltoid for a couple of inches. He then sweeps the edge in a curvilinear direction, first forwards, and then backwards, as far as the axillary borders; disarticulates; and, everting the head of the bone, clears its neck of soft parts—dividing the textures in the floor of the axilla, between the two incisions, either from within outwards, or from without inwards, with a concluding sweep of the knife. When the neck of the bone is so shattered as to afford no hold for fingers or forceps, disarticulation is facilitated by carrying the forefinger into the shoulder-joint, so as to direct the knife in dividing the tendons of the supra and infra-spinati and subscapularis muscles. In gunshot wounds, when the laceration is very great, no formal flaps can be shaped from the shreds of soft parts which remain, so as to conform to any of the more regular methods already described. The operation may, in such circumstances, consist in little else than dissecting out the shattered head of the humerus, and cutting through the fleshy, cutaneous, and tendinous tags which still attach the arm to the trunk. The axillary artery, whether bleeding or not, should always be secured by ligature; and the axillary nerves should be shortened, by drawing them out, and dividing them, while the patient is under chloroform. Such a raw, irregular surface, often heals both rapidly and kindly by cicatricial contraction. In many cases of bullet-wound, with comminution of the head of the bone, excision of the shattered bone and its articulating surface will be found to suffice without sacrificing the whole limb.

After cicatrization, the stump requires artificial protection ; otherwise the prominent acromion is apt to sustain injury.

Excision and Amputation of the Scapula.

The scapula may require removal, either with the arm or by itself. Portions of this bone have frequently been removed on account of tumours (Haymann, Liston, Jansen, Luke, Syme, Wützer, Testor, Travers). The scapula has also been excised, in part or entire, or even with a portion of the clavicle, in cases where the arm had been previously amputated (Massey, Rigaud, Fergusson). Complete resection, leaving the arm, has twice been practised by Mr. Syme ; first, in the case of an elderly female with osteo-aneurism of the scapula ; secondly, in the case of a man in whom he had previously excised the head of the humerus on account of medullary disease. The incisions required may be either of a T or + form. In the former, the long incision should extend from the acromio-clavicular articulation to the inferior angle of the scapula ; the short one from the centre of the latter to the posterior superior angle, or border of the bone. In the crucial form of operation, the second incision just described is extended, not merely to the long wound first made, but across it to the border of the axilla. The flaps formed in either method are dissected off the surface of the tumour ; the acromio-clavicular articulation is opened, and the coraco-clavicular ligaments cut through ; or the clavicle is divided by bone-pliers on the sternal side of the insertion of those ligaments. Disarticulation of the scapulo-humeral joint is then effected, and the long head of the biceps cut through. The muscular attachments of the vertebral margin of the bone are next severed, the bone turned outwards, and its remaining attachments cut away. The subscapular and suprascapular arteries require deligation, along with smaller vessels towards the posterior margin and under surface of the bone. The flaps, having been laid down upon the thoracic parietes, are united by suture. In the result, the movements of the forearm and hand remain perfect. The arm, too, retains all its freedom, but does not admit of abduction or circumduction.

Amputation of the superior extremity along with the scapula still requires consideration. This has now occurred, and been recovered from, with sufficient frequency, as the result of accident—the parts having been torn away in machine-injuries—to render it in suitable cases a fit object of imitation as a regular procedure in surgery. Even already several successful cases attest the safety and satisfactory character of the operation. The incisions required are merely extensions of those employed in amputation at the shoulder-joint. They consist of two semilunar cuts ; the upper and posterior of which commences over the outer third of the clavicle, and terminates at the inferior angle of the scapula ; while the anterior, commencing at the same point, divides the anterior fold of the axilla, severs only the skin in the floor of that cavity, and terminates in the posterior extremity of the first incision. The posterior flap having been raised, the attachments of the vertebral margin and angle of the scapula having been cut through, the acromio-clavicular joint having been divided, and, by a little dissection, the scapula with

the humerus having been turned forwards, the remaining soft parts in the floor of the axilla are last of all severed with a sweep of the knife, which keeps to the line of incision which had already been traced superficially.

Such an operation can only be required in cases of large tumours, involving both the scapula and the upper part of the shaft of the humerus. In cases of injury, no fixed plan can be laid down for the incisions ; they must vary according to the circumstances of the case. Probably the greater part of the wound will be found already made.

AMPUTATIONS OF THE LOWER EXTREMITY.

Amputation of the Toes.

The *Phalanges* of the toes may be removed in the same way as those of the fingers. In any toe, however, except the great one, when amputation is required, there is no advantage gained by preserving a portion. The amputation of the lesser toes is therefore usually practised at the metatarso-phalangeal joint. In effecting this, it should be borne in mind that the articulation lies considerably further back than the corresponding joint of the superior extremity ; and the incisions require to be made accordingly. The site of the articulation is made out by recognition of the extremity of the metatarsal bone, which is most easily made out upon the plantar surface. There is no absolute necessity for removing the head of the metatarsal bone ; on the contrary—the more ample the base of support, the more efficient is the function of the foot. In cases of injury of the great toe, however, or in cases of disease affecting its metatarso-phalangeal articulation, it had better be taken away ; in cases of injury—because all the soft parts, which can be retained to form flaps, will not cover it ; in the case of disease—because its articulating surface partakes in the morbid change which necessitates operation. When the head of the bone is to be left, the antero-posterior flaps require to extend as far forwards as the web between it and the second toe ; and in the oval operation, the incision should not separate to encircle the toe till within a quarter of an inch of the same point.

The Metatarsal Bone of the Great Toe is not unfrequently diseased in the greater part of its extent. It may be disarticulated ; but it is better to divide it a little below its base, if possible, in order to leave the tendinous insertion there undisturbed. By a bistoury, such a flap is indicated as will efficiently cover the wound. The instrument is entered over the tarsal articulation, on the dorsum of the bone, and is carried down, along the dorsum, until the metatarsal joint is reached ; a sweep is then made on the inner side of this—or rather a little below the joint ; and the incision is continued upwards, leaving an interspace of about an inch and a half between the returning line of wound and that which descended. The flap, thus indicated, is dissected up ; the bone, along with the corresponding toe, is isolated from its connections—carrying the point of the knife as close to the bone as possible, so as not to injure the soft parts in the sole of the foot—and is either disarticulated, or cut

across by the pliers, according to circumstances. In disarticulating, the position of the communicating artery, between the internal plantar and dorsal artery of the foot, should be borne in mind ; as when either it or the plantar is wounded, troublesome bleeding is sure to ensue, sometimes defying every effort to secure the orifice by forceps and ligature. In such circumstances, a graduated compress and bandage should be employed. After removal of the diseased part, and arrest of hemorrhage, the flap is brought down, and adjusted to the raw surface. To avoid cutting into the sole of the foot, the toe and its metatarsal bone can easily be removed by a straight incision along the dorsum of the foot, bifurcating at the metatarso-phalangeal joint, and encircling the root of the toe at its line of flexure upon the sole. The cicatrix is linear, and corresponds entirely to the dorsum of the foot.

The other Metatarsal Bones are liable to the same operations as the analogous bones of the superior extremity. A very useful foot may be left, after removal of even three of the toes with their metatarsal bones, especially when those which remain are the great toe and its fellow.

In estimating the extent of incisions required, it is important to remember the oblique direction of the metatarsal range.

Amputations of the Foot.

All the toes may require removal at their metatarsal articulations, on account of frost-bite. A transverse incision is made on the dorsal aspect ; sloping inwards, so as to make a short anterior flap. Disarticulation is then effected, at each joint ; and, the blade of the knife having been laid behind the heads of the phalanges, a suitable flap is made from the plantar aspect.

In the case of more extensive disease or injury, similar flaps may be formed—the plantar being made by transfixion ; and then the metatarsal bones are divided by the saw or bone-pliers.

Hey's or Lisfranc's Amputation.—The whole metatarsal range may be taken away, leaving the remainder of the foot very useful for progression. Hemorrhage is restrained by the pressure of an assistant at the ankle—mainly exerted on the posterior tibial. The patient is laid recumbent on a table, with the foot projecting over the edge. The surgeon, with his left hand, steadies and commands the toes. On the right foot, the prominence of the base of the metatarsal bone of the little toe is felt for ; the knife's edge, laid on immediately above this, is carried across the dorsum of the foot in a semilunar direction, terminating at the articulation of the base of the metatarsal bone of the great toe with the internal cuneiform bone. This last point can usually be felt in cases where there is no thickening of the parts ; otherwise, its situation corresponds to a point midway between the internal malleolus and distal end of the metatarsal bone of the great toe. The line of incision is thus oblique, the inner extremity being about three-quarters of an inch anterior to the outer. The short anterior flap, thus indicated, may be dissected up. The spontaneous retraction of the flap usually, however, suffices to expose the line of articulation. Across this the knife is swept, and should open at once the articulations of the three outer toes, and usually

that of the great toe as well; the solution of continuity being assisted by the surgeon forcibly depressing the toes and metatarsal range, so as to render the joints more open. The projection backwards of the triangular base of the metatarsal bone of the second toe in the mortice joint between the first and third cuneiform bones, and the presence of the strong plantar ligaments which pass from the first cuneiform to the second and third metatarsal bones, must be recollected by the operator. The portion of the articulation between the second metatarsal and second cuneiform is easily opened, by a transverse incision about a quarter of an inch behind the general line of the articulations; but the resistance of the plantar ligaments is best overcome by passing the point of the knife, edge forwards, into the interspace between the first and second, and afterwards between the second and third, at an angle of 45° , so as to lodge the back of the point upon the upper surface of the tendon of the peroneus longus, and thus effect division of the ligament without injury to the soft parts in the sole, when the handle of the knife is raised to the perpendicular position. Should ankylosis have taken place

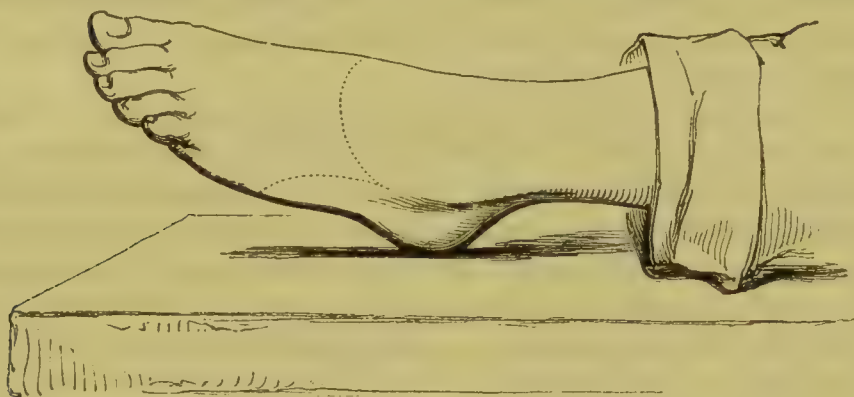


Fig. 383.

the pliers or saw are to be employed; dividing the bone on a line with the general range of articulation. Disjunction having been completed by the point of the knife, the blade may be laid on behind, and a sufficient flap made from the sole of the foot—longer on the inner than on the outer aspect. Or the flap may be fashioned, and dissected up, perhaps more accurately, by cutting from without inwards. This plantar flap requires to extend as far forward as the extremities of the metatarsal bones. The bleeding vessels having been secured, the flaps are adjusted by suture and strap; the line of union corresponding to the dorsum of the foot. Where the tissues of the sole are destroyed, and only a short plantar flap can be obtained, a commensurately large flap must be mapped out from the textures of the dorsum.

In operating on the left foot, the dorsal incision is begun over the articulation of the metatarsal bone of the great toe with the internal cuneiform bone, and terminates behind the prominent head of the metatarsal bone of the little toe; in other respects, the operation is the same. When the projecting cuneiform bone comes in the way of the union of the angle of the two flaps, it may be removed by the saw and pliers, as recommended by Mr. Hey.

Fig. 383. Amputation of the foot.—CHOPART'S.

In cases of injury, frost-bite, or gangrene, implicating the extremity of the metatarsus, it is usually unnecessary to resort to any such formal operation as that just described; a dorsal and plantar flap having been mapped out from the sound tissues which remain, they are reflected to such an extent as to enable the bones divided by the saw to be completely invested by a sufficient covering of soft parts.

Chopart's Operation.—Amputation may be performed still higher, leaving a useful stump. Disjunction is effected at the articulation between the astragalus and os calcis with the navicular and cuboid bones. All the bones of the foot and tarsus are thus removed, except the astragalus and calcaneum. The operation is conducted on the same principles as the preceding; a curvilinear incision being made upon the dorsum a little in front of the articulations; and the main flap being obtained from the sole of the foot. The marks for laying on the knife in its dorsal sweep are: the articulation of the navicular bone with the astragalus—behind the prominence of the navicular bone, in front of the inner ankle; and the articulation of the cuboid with the os calcis—about midway between the outer ankle and the prominent base of the metatarsal bone of the little toe. Often, however, these marks cannot be discerned, on account of swelling.

After cicatrization, the stump of the soft parts of the foot is not displaced backwards, so as to bring the cicatrix in contact with the ground in walking, as might have been expected; but the bones undergo a degree of rotation within the stump which directs the articulating surfaces of the os calcis and astragalus directly downwards, so as to support the whole weight in walking. Thus, in many cases, is produced a tender, useless stump—even accompanied with suppuration—so as to require a second amputation at the ankle to afford the patient a useful limb. Division of the tendo Achillis during cicatrization, as a preventive, or afterwards as a remedy, has not been found sufficient to attain its object.

Amputation of the foot—intermediate between the two preceding—may be performed, by disarticulating the cuneiform bones from the navicular, and sawing the cuboid bone across at a corresponding point. The general plan of the incisions is the same as in the two preceding cases.

Resection of the Ankle.

When disease in consequence of gunshot wound or compound fracture is limited to the ankle-joint and upper part of the tarsus, it is a question whether or not excision of the diseased parts may not be performed, leaving the foot. On this principle Mr. Wakley in 1848 removed the calcaneum and astragalus, at the same time sawing off the malleolar surfaces of the tibia and fibula.* Similar operations have been performed by others; but with an unfortunate result. Idiopathic disease, from its tendency to involve more or less all the bones of the tarsus, can only be efficiently treated by amputation at the ankle-joint. If the os calcis, astragalus, and malleoli, are to be removed satisfactorily, the incisions should be as limited as possible, so as to interfere with none of the blood-vessels, nerves, and tendons on the inner or anterior

* Lancet, No. 1296, p. 5; also Guthrie's Commentaries, p. 108.

aspect of the ankle. Sufficient room will be obtained by an incision parallel with the sole of the foot, carried round the heel below the tuberosity of the os calcis, from the calcaneo-cuboid articulation on the outer, to a corresponding point on the inner side ; this is joined by a perpendicular incision corresponding to the outer margin of the tendo Achillis ; the flap from the sole is then dissected up and turned forwards ; and the two lateral flaps, after division of the tendo Achillis, are detached from the bones, particular care being taken of the posterior tibial artery and nerves. The peronei tendons may be sacrificed or not, according to the condition of parts. The osseous structures having now been thoroughly exposed, are removed by means of the bone-pliers. In one case, I removed the whole os calcis and astragalus by means of the gouge, with a far less extensive incision than that described. In another instance, the whole of the interior of the os calcis was taken away through an incision along the outer side of the bone, met by another at right angles extending upwards along the margin of the tendo Achillis. The result in both was most successful. Further experience of such operations, however, is required, ere they can be received as substitutes for that next described.

Amputation at the Ankle.

When, in injury, the soft parts of the heel are sound, and no part of the foot and tarsus can be saved, amputation is required either in the leg or at the ankle. The latter site is preferable on more than one account ; risk to life is less ; mutilation is not so severe ; and the stump is not only more useful in progression, but also less liable to neuralgia and exfoliation. Disease of the ankle-joint does not contra-indicate the operation, unless the affection of the bone extends beyond the articulating end of the tibia. And, in most cases of disease of the tarsus and metatarsus, it were now indeed unwarrantable to perform any other operation.

For the revival of this operation, and the introduction of the satisfactory procedure which bears his name, the profession is indebted to Mr. Syme.

The patient having been suitably arranged on a table, a tourniquet is applied, so as to compress the popliteal artery ; or the fingers of an assistant may be employed, as in the partial amputations of the foot. A stout bistoury or short amputating knife is required for the operation. " The foot being placed at a right angle to the leg, a line drawn from the centre of one malleolus to that of the other, directly across the sole of the foot, will shew the proper extent of the posterior flap. The knife should be entered close up to the fibular malleolus, and carried to a point on the same level of the opposite side, which will be a little below the tibial malleolus. The anterior incision should join the two points just mentioned at an angle of 45° to the sole of the foot and long axis of the leg. In dissecting the posterior flap, the operator should place the fingers of his left hand upon the heel, while the thumb rests upon the edge of the integuments, and then cut between the nail of the thumb and tuberosity of the os calcis, so as to avoid lacerating the soft parts

which he, at the same time, gently but steadily presses back until he exposes and divides the tendo Achillis. The foot should be disarticu-



Fig. 384.

lated before the malleolar projections are removed, which it is always proper to do, and which may be most easily effected by passing a knife round the exposed extremities of the bones, and then sawing off a thin slice of the tibia connecting the two processes."* Some have recommended that the operation should be conducted by completely opening the joint from the front, before dissecting off the

soft parts from the calcaneum ; and some have even so far departed, without reason, from the method of the originator, as to dissect the os calcis out of the heel flap, instead of the heel flap from the os calcis. Such variations in the procedure have created confusion in the minds of subsequent imitators, and produced disastrous results, by sloughing of the flap—such as are not met with here, when the operation has been properly performed. Bleeding having been arrested, the flaps are brought together by suture ; and care must be taken, during the cure, to prevent accumulation of pus in the pouch which may be formed by the posterior flap. After cicatrization, a most efficient, round, callous stump is produced ; the patient resting on the integuments of the heel—well accustomed to pressure—and retaining a full use of the knee and leg.

Division of the posterior tibial artery, behind the internal malleolus, in clearing the ends of the tibia and fibula, as a preliminary to the removal of the malleoli, should be carefully avoided ; as by such wound the calcaneal branches will be deprived of their supply of blood, and partial or complete sloughing of the flap will be almost sure to follow. It is probable, however, in many cases in which sloughing has occurred, that the accident was not wholly attributable to deficiency of arterial supply, but to the operator using undue force in dissecting back the heel flap, as well as scoring the flap, instead of keeping close to the surface of the bone in using the knife.

Should circumstances not be suitable to the plan of incision as above described—as, for example, when the soft parts over the external aspect of the os calcis have sloughed, or are involved in malignant disease—then the following procedure, originally recommended by the late Dr. J. R. Mackenzie, may be advantageously adopted :—

“ On the Right Foot.—The body reclining on the right side, and the foot and ankle projecting beyond the table with their internal aspect upwards, the point of the knife is entered in the mesial line of the posterior aspect of the ankle, on a level with the articulation, carried downwards obliquely across the *tendo Achillis* towards the external border

* SYME, Contributions to Surgery, p. 146 ; and Monthly Journal, Feb. 1850, p. 173.

of the plantar aspect of the heel, along which it is continued in a semilunar direction. The incision is then curved across the sole of the foot, and terminates on the inner side of the tendon of the *tibialis anticus*, about an inch in front of the inner *malleolus*.

"The second incision is carried across the outer aspect of the ankle in a semilunar direction, between the extremities of the first incisions, the convexity of the incision downwards, and passing half an inch below the external *malleolus*.

"The flap is now dissected up, care being taken that the knife cuts close on the bones, so as to preserve the whole thickness of the soft parts. By holding the base of the flap between the fingers and thumb, as it is detached from the bones, all risk of wounding the artery at this stage is avoided. The foot is then severed



Fig. 385.

at the articulation, and the ends of the *tibia* and *fibula* cleared so as to allow of the application of the saw, by which a thin slice of the extremities of these bones is removed, as in Mr. Syme's operation.

"The operation on the left foot is the same, but, as the patient reclines on the left side, the order of incision is reversed, the knife being first entered at the point above indicated, in front of the inner *malleolus*.

"The accompanying sketch represents the form of the stump which is



Fig. 386.



Fig. 387.

left, which, it will be observed, differs from that formed by Mr. Syme's operation only in the situation of the cicatrix, which is here on the fibular side of the stump. With an artificial foot, the patients are able to walk with ease, and but slightly perceptible lameness, the weight of the body resting on the face of the stump."

Pirogoff's Operation—in which the tuberosity of the os calcis is sawn off, after preliminary disarticulation of the ankle-joint, and retained in the heel flap, with the object of its becoming permanently united to the end of the tibia—is liable to the double objection, that it makes the stump too long for the comfortable adaptation of an artificial foot, and by presenting the thinly covered posterior surface of the tuberosity to the ground, instead of the thick elastic cushion of the sole, renders the limb much less serviceable than after the ankle-joint amputation. In consequence, Professor Pirogoff has frankly abandoned this operation, preferring Mr. Syme's. Nevertheless, some operators at the present day continue to experiment upon their patients by its performance, to the manifest detriment of the surgical art.

Amputation of the Leg

Is chiefly required for injuries, gangrene, and malignant disease.

Near the ankle, a fleshy stump is not to be obtained in thin persons ; and in these, consequently, it has hitherto been considered necessary to cut somewhat higher than otherwise might have been desired ; “The site of election” being, for division of the bones, four inches below the tuberosity of the tibia. On the other hand, there are stout limbs—their rotundity mainly caused by a solid œdema—in which it is desirable to amputate low down, in order to avoid redundancy of soft parts. In amputating low down in the leg, a modification of Mr. Teale's amputation seems to afford satisfactory results, and to be well suited to lesions of the foot, in which the soft parts of the heel are so injured as to preclude the adoption of amputation at the ankle.

Hæmorrhage is restrained by pressure on the popliteal, by means of a tourniquet, if one is at hand ; or by the fingers of an assistant pressing on the femoral artery, as it passes over the brim of the pelvis. The patient is laid on a firm table, of convenient height, with the limbs projecting over its edge ; the sound ankle is secured to the leg of the table by means of a towel—the work of an additional assistant being thus spared ; and the doomed limb is supported by an assistant seated in front. The surgeon, feeling the exact outline of the bones, at the part where they are to be divided, makes sure that he has sound integumental tissues below that point, equal in length to the diameter of the limb. He next carries the point and edge of a short amputating knife downwards, along the posterior margin of the bone furthest from him, to nearly the indicated extent ; curving the incision forwards across the front of the limb, in a semilunar direction. He then turns the point and edge of the knife upwards along the posterior margin of the bone nearest him, and terminates the incision precisely opposite the spot at which the knife began its course. This flap, so marked out, is raised along with all the muscles in the interosseous space. To raise them, and at the same time to secure himself against inflicting an injury upon the anterior tibial artery, the knife is used only to separate the muscles from the bones on each side ; the fingers pushing them away from the interosseous membrane till the flap is fully retracted. The soft parts upon the back of the leg are next divided, by a transverse sweep of the knife that unites

the angles of the flap ; and further retraction of the soft parts is effected, so as to denude the bones for about an inch higher ; and there they are sawn through. In dividing them, the prominent spine of the tibia should be cut off obliquely, lest its sharp point should afterwards make its way through the centre of the flap. In sawing the two bones the fibula should be first divided.

When the operation by transfixion is practised, the flap is obtained almost entirely from behind. The same preliminaries having been arranged, the surgeon indicates the posterior margins of the tibia and fibula by the forefinger and thumb of the left hand, and transfixes immediately above them, passing his knife as closely as possible to the posterior surface of the bones ; and by carrying it downwards and outwards, a long posterior flap is formed. The knife is then laid on at the upper margin of the wound ; by a sweep in front, in a semilunar direc-

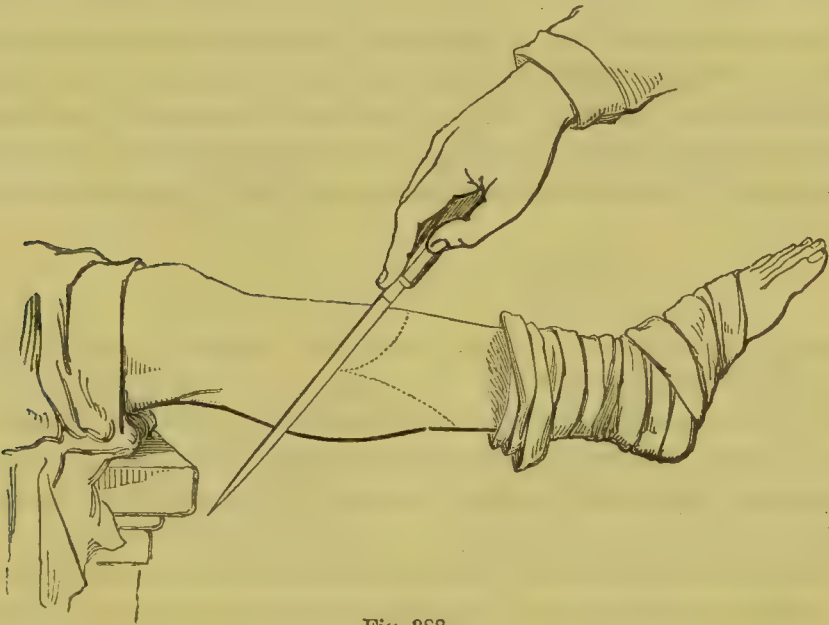


Fig. 388.

tion, the integument is divided ; this having been retracted, the interosseous space is cleared by the knife passed between the bones ; and the saw is then applied as close to the soft parts as possible. Bleeding having been arrested, the flap is brought up and secured.

With the alleged object of facilitating transfixion, and guarding against locking of the knife between the bones, a little alteration in the procedure may be practised. Supposing that the right leg is operated on, the point of the blade is entered on the outside of the fibula, about an inch, or more, beneath the point where transfixion is contemplated ; with a sawing motion the instrument is carried upwards along the outside of the bone, until the site of transfixion is reached ; the blade is then carried across sweepingly in front, to form the anterior wound ; and, the point having arrived at the inside of the tibia, transfixion is effected—the instrument emerging at the upper part of the wound formerly made on the outside of the fibula.

In operating immediately below the knee, the fibula is sawn across, along with the tibia. Disarticulation of the head of the former bone

Fig. 388. Amputation of the leg.

may improve the appearance of the stump, at the time of its formation ; but experience has shown that the procedure is not warrantable, on account of the risk of subsequent inflammatory seizure in the knee-joint.

When a short stump is made, the patient usually rests on the knee, with the leg bent at right angles ; and to the knee the artificial limb is adapted. When the stump is long, however, the motions of the knee-joint are retained, and the false limb is adapted to the leg immediately above the cicatrix.

When stout muscular men sustain such injury of the leg as requires amputation below the knee, a redundancy of flesh cannot fail to be obtained in the flap, by the ordinary mode of operation. And, accordingly, Liston advised, in such cases, a modification of the circular amputation. "Supposing the left leg to be injured :—with a common amputating knife an anterior semilunar incision is made through the skin, commencing from the inner side of the tibia, about four fingers' breadth below its superior extremity, and passing over its anterior aspect. A similar semilunar incision is made at the posterior part of the leg, its extremities joining the horns of the previous incision. The integument is then reflected upwards to a sufficient extent to cover the bones, and the operation is finished after the manner of the circular amputation."

Amputation at the Knee-Joint.

Latterly, this operation has also been revived ; when injury or disease extend no higher than the condyles of the femur, and involve these only to a superficial extent. A semilunar incision is made on the front of the limb, passing beneath the patella ; the integuments are dissected up, and transfexion is made behind ; by cutting downwards, a very long flap is made from the back part of the leg ; and, the soft parts having been all detached, section of the bone is made through the condyles. Bleeding having been arrested, the flaps are approximated. The operation is easily enough accomplished, but experience seems to have unequivocally decided against its revival. More recently, amputation by an anterior flap, according to the modified method of Mr. Teale, has been practised with satisfactory results—the patella being retained, and the bone divided through the cancellated tissue of the condyles. The soft parts which corresponded to the ligamentum patellæ and tuberosity now cover the end of the femur, and afford a surface which, like the textures covering the os calcis, it is not unreasonable to expect, may be calculated efficiently to support the weight of the trunk at least in part.

Amputation of the Thigh.

The patient is arranged as for amputation below the knee, but with the pelvis resting on the edge of the table. The femoral is compressed by an assistant, as it passes over the horizontal ramus of the pubes. Or, in weakly anæmic subjects, when the amputation is sufficiently low down to admit of its use, the tourniquet may be applied to compress the femoral artery in Scarpa's space. The operation is by double flaps.

Low down in the thigh, from the tendency to retract, especially on

the part of the powerful flexors of the knee—cut so far from their origin—amputation by transfixion was found till lately unsatisfactory, in whatever way performed. So that, practically, though the flaps might be formed from the soft parts in the lower third of the thigh, yet if the stump turned out a good one, the bone was always found to have been divided either in the lower part or about the centre of the middle third. Even the operation of Vermale, by which a suitable amount and character of soft parts was attempted to be obtained from the lateral aspects of the limb, by perpendicular transfixion, proved unsatisfactory. For long, therefore, amputation in the lower third of the thigh has been practised either by circular incision, or according to its modification by which short areolo-cutaneous flaps are reflected from the anterior and posterior aspects



Fig. 389.

of the limb, to about two inches above their angles of junction ; and then the muscles in front are divided as high up as exposed ; those behind being severed as low down as possible, so as to admit of their retracting independently of the flap. A retractor is then employed to expose the bone as high as may be ; and there it is divided.

More recently, as already explained, either Mr. Teale's amputation or the modification of it formerly described (pp. 1351-2), has been adopted here by all our hospital staff, with results of a perfectly satisfactory nature.

In the middle and upper part of the thigh, the same method may be practised with quite as satisfactory a result ; in fact in the highest amputation possible—at the hip joint—when the textures in front are available for the purpose, it probably constitutes the best method of procedure ; either with a short posterior flap, or with a smooth perpendicular section of the muscles on the back of the pelvis. There is not, however, the same necessity for resorting to its employment to the exclusion of the method by transfixion ; for the distance between the origin and point of

Fig. 389. Amputation of the thigh.

division of the muscular textures is so much shorter as to render the effects of retraction less seriously felt. In transfixion, the flaps are anterior and posterior; transfixion is horizontal; and the operation is performed in the same way as the analogous procedure in the arm. Formerly it was recommended that the posterior flap should be considerably longer than that in front; to compensate for the greater displacement upwards, by contraction, to which the muscles on the posterior part of the thigh are liable—and also to neutralize the greater amount of permanent atrophy by absorption, which the posterior flap invariably undergoes. Now, on the contrary, compensation is effected for both these conditions by making both a broad and long anterior flap. To effect this, the surgeon should not only grasp the parts in front of the thigh in his hand, before entering the knife, but the assistant who is to retract the flaps should press forwards with the palm of his hand as much of the tissues from the back of the thigh as possible, in order that they may be included in the anterior flap, and constitute a permanent covering for the end of the bone. Immediately after section by the saw, the muscles inserted into the trochanter-minor project the end of the bone forwards; and, in consequence of this, protrusion at the upper angle of the wound would be apt to take place, were the flaps made laterally; while, as it is, the more the bone is bent forwards, the more completely is its extremity covered by the anterior flap.

Amputation at the Hip-Joint.

Amputation at the hip-joint is seldom required. The operation is one of great severity, and eminently perilous to life; yet, when circumstances are urgent and decided, we need not shrink from its performance. For malignant disease of the femur, the operation should never be urged upon the patient—as a general rule; experience having shewn that, even although the operation itself may be temporarily successful, return of disease in the interior has carried off the sufferer. Still there are favourable cases, when the patient's general health remains good, and no local conditions forbid operation, where we should undoubtedly consent to his expressed wish. In many cases of injury high up in the thigh, by gunshot, railway accident, or compound fracture, the operation should be unhesitatingly undertaken; not because it is less fatal under such circumstances, but because it affords the only, though that may be but a faint chance of recovery. The operation is certainly deprived of its horror and danger to a great extent, by the use of chloroform, and by the employment of the abdominal aortic compressor. If the latter is not at hand, a small book may be employed for the purpose, the compression being effected by manual strength.

The patient is placed on the table, with his pelvis projecting from the edge. Two assistants hold him steady by the shoulders to prevent the table tilting, or the patient slipping off. A steady assistant, conducting the compression, is ready to follow the knife with his fingers, during formation of the anterior flap, so that he may grasp the end of the vessel almost as soon as it is divided. The chief assistant supports and controls the limb, ready to follow the movements of the operator's knife

without requiring any direction, and without unnecessary delay. In the left thigh, the knife, at least half as long again as the diameter of the thigh at the groin, is entered about midway between the trochanter major and the anterior superior spinous process of the ilium, and is made to emerge on the inside of the thigh, after having passed in a somewhat curved direction over the articulation; the assistant, who supports the limb, gently flexing and rotating the thigh inwards. By cutting downwards, while the assistant again extends the limb to make the tissues moderately tense, a suitable anterior flap is formed. The assistant, then abducting the thigh, presses it backwards; and by a determined sweep of the knife across the undivided adductor muscles, and over the head of the bone thus made prominent, the joint is cut into. With the point of the instrument, the round ligament is divided, and disarticulation effected. The blade of the knife is then placed behind the bone, and carried either perpendicularly backwards (Malgaigne), or downwards



Fig. 390.

and backwards, so as to form a posterior flap; the assistant adducting the limb so as to prevent locking of the instrument by the trochanter major. Or the posterior flap may be formed by cutting from without inwards. However made, it is instantly covered by a sponge; and the vessels there are rapidly secured. Afterwards, the assistant is relieved from his charge of the femoral.

By some, the formation of lateral flaps is preferred. Not unfrequently, in cases of injury, there may be no room for selection; the extent of the accidental wound precluding all attempts at regular operation, and compelling the surgeon to shape his flaps according to what may be, perhaps, quite an original mode of procedure. In three cases in which Dr. Watson amputated at the hip-joint for injury, the flaps were obtained thus:—in one, from the inner side of the thigh altogether;

Fig. 390. Amputation at the hip-joint.

in another, from the areolo-cutaneous tissue dissected up equally on the inner and outer side of the limb, the angle of the flaps meeting in front over the femoral artery which lay exposed in the laceration ; in the third, a small flap was obtained from the antero-internal region of the thigh, and a large areolo-cutaneous one from the trochanteric and gluteal region.

Affections of Stumps.

Neuralgia of the stump is no unfrequent result of amputation, however skilfully conducted. It is most commonly observed after amputation below the knee, and in the arm and forearm. If no change of structure in the nerve can be detected, the treatment must be such as is suitable for neuralgia in general ; and, of the remedies usually found most useful, iron internally, and the light application of nitrate of silver to the part, may be specially mentioned. If neuromata plainly exist, entangled with the dense cicatrix, they ought either to be disconnected with the nervous centre by subcutaneous section of the nerve upon which they have formed, or altogether removed ; and, for this purpose, either excision by dissection, or a repetition of the amputation on a minor scale, is necessary ; care being taken, in the fashioning of the stump, and in the after-treatment of it, that the nerves be not again similarly circumstanced. Not unfrequently, however, notwithstanding every care, neuralgia returns—obviously dependent on a general more than on a local cause. The neuralgic part should not be pressed upon, in the adaptation of any artificial limb.

Exfoliation from the stump seldom follows a well-conducted operation. It is most likely to occur, when section has been made in the dense part of the bone—as in the middle of the femur. The sequestrum may consist of a mere scale from the sawn surface ; or it may be of some length—involving the whole thickness of the bone at its lower part, and tapering, upwards, of a cancellous texture. Healing of the wound is necessarily delayed, until detachment and extrusion of the sequestrum have taken place.

Sometimes, in an ill-formed stump, or when the soft parts have perished by sloughing, the end of the bone projects uncovered, partially necrosed, and in part, perhaps, expanded like a mushroom covered with large, pouting, firm granulations, the result of transformation of the osseous tissue into granulation material. In such a case, renewal of the amputation is necessary ; or the making of such incisions as may admit of the bone being cleared and sawn through, at a point sufficiently high for obtaining subsequent fleshy covering.

The accidents of exfoliation, and protrusion of the end of the bone, ought to be prevented ; by fashioning the flap, or flaps, so as to afford a full covering for the end of the bone—allowance being always made for subsequent contraction and atrophy ; by sawing the bone, carefully, close to its connection with the soft parts—not leaving any portion bare and projecting, stripped of both flesh and periosteum, at the time of the operation ; by so conducting the cure as to prevent untoward inflam-

matory accessions, whereby ulceration, sloughing, or long gaping of the wound might occur ; by opposing excessive retraction of the muscles, if need be, by bandaging—in those cases in which the process of granulation is interrupted or tedious. The face of a well-formed stump is “fenced with firm skin, and no more liable to accident than a man’s finger-ends.”

A *Bursa* usually forms over the end of the bone ; favouring tolerance of pressure. A blow, or other injury, may induce painful enlargement of this ; and the fluctuation, and other characters of the swelling, may simulate the condition of acute abscess very closely. Accuracy of diagnosis is obviously of importance ; as, in the one case, early incision is advisable ; while, in the other, rest and fomentation, with perhaps leeching, prove sufficient.

Hemorrhage.—After-bleeding, taking place within a few hours after the operation—when the patient grows warm in bed, and recovers fully from the state of shock—usually requires an undoing of the wound, and the application of ligatures to the open vessels. But if, at the time of operation, due care have been taken to apply deligation accurately to each likely orifice, the occurrence of such a casualty need seldom be apprehended.

Hemorrhage which occurs at a more remote period, in consequence of ulceration having attacked the stump, may, if slight, be restrained by pressure. But, in general, deligation of the arterial trunk at the bleeding point is necessary. In some cases deligation of the femoral, after amputation below the knee, or deligation of the humeral, after amputation of the forearm, has been deemed necessary.

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